JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

AND

MECHANICS' REGISTER.

JUNE, 1839.

Practical and Theoretical Mechanics and Chemistry.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

An Analysis of a Specimen of the Iron Ore from the celebrated "Iron Mountain," Missouri. By Robert E. Rogers, M. D., and Martin H. Boyé.

The celebrity which this iron ore has acquired from its reputed abundance and superior qualities, giving rise to extensive speculations, may render the following brief examination of it not without interest. The specimen furnished us was regarded as one representing the better quality of ore from this region.

Colour; steel gray, metallic lustre; compact crystalline texture; powder, purpleish brown; interspersed sparsely with white particles of quartzose gangue, scratches glass with facility, and is of very difficult fracture. It acts strongly upon the magnet, and exhibits polarity. Specific gravity, 4.78.

As the method adopted in the quantitative analysis of this ore is applicable generally to those iron ores containing, like this, only the oxides of iron, alumina and silica, as fixed substances, we give the details.

1.561 grammes of the finely pulverized ore was digested with muriatic acid until complete decomposition was effected, leaving the insoluble matter of a white, or light yellowish, colour; nitric acid was added, and the whole evaporated to perfect dryness; treated again with muriatic acid, then diluted and filtered. The insoluble matter thus obtained was dried at the temperature of 212°, which, after subtracting the weight of the filter, yielded 0.176, or 11.26 per cent. This was carefully washed from the filter, and boiled with a solution of carbonate of potassa, which dissolved the silica which had been chemically combined with the iron, leaving the gangue which had been mechanically admixed in the ore. The solution of carbon-

ate of potassa was over saturated with muriatic acid, and evaporated to dryness, and the silica thus rendered insoluble was filtered, washed, and ignited, and yielded 0.016, or 1.02 per cent., which, subtracted from the above amount, leaves 10.24 per cent. for the gangue, which, under the blow pipe, proved to be quartzose.

The muriatic solution containing the iron was treated with caustic potassa in excess, to precipitate the iron, heated to ebullition and quickly filtered. Muriatic acid was now added in excess to the alkaline solution, and subsequently neutralized with carb. ammonia, to determine the presence and amount of alumina, which separated in only a few floculi. The peroxide of iron which had been precipitated by the potassa, was next dissolved by muriatic acid, and again thrown down by ammonia, carefully washed, ignited and weighed, yielding as peroxide of iron, 1.409, or 90.26 per cent.

By recapitulation, then, we have in the analysis for the 100 of the ore,—

Quartzose Gangue, ...	10.24
Silica, ...	1.02
Alumina, ...	a trace
Perox. iron, . . .	90.26
	101.52

The excess is owing to a portion of the iron being in the state of *protoxide* in the ore. Calculated from this excess, the amount of protoxide would be 13.35 per cent., which requires precisely 1.52 of oxygen for its conversion into peroxide. 1.16 of the protoxide must be supposed to be combined with the silica, to form the subsesquisilicate of iron, the most common silicate in nature. The remaining 12.19, to be associated with the peroxide to form the magnetic oxide, would require of this latter 27.16. The constituents thus arranged will stand in the following proportions,—

Peroxide of iron, (Specular Iron) . .	48.23
Magnetic oxide, ...	39.35
Silicate of iron, ...	2.18
Alumina	a trace
Gangue, ...	10.24
	100.00

Accordingly, then, the ore, as a mineral, proves to be chiefly a mixture of Specular Iron and Magnetic Iron Ore.

The per centage of metallic iron in this ore is 62.58, while it may be well to remark, that the richest iron ore occurring in nature, the Magnetic, contains in its perfect purity, 71.8 per cent. The per centage in pure Specular Iron is 69.3.

Physical Science.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on Mr. Espy's Theory of Centripetal Storms, including a Refutation of his Positions relative to the Storm of September 3rd, 1821: with some Notice of the Fallacies which appear in his Examinations of other Storms. By W. C. REDFIELD.

(Concluded from p. 336.)

Having now done with Mr. Espy's array of numerical positions, we are next told that "the wind also changed round at Norfolk S.W. some time before it set in at New York. Also, two ships at sea, opposite the Jersey coast, had the wind blowing a gale from E.S.E. to S.S.E. At the same time, the wind was violent at Philadelphia and Reedy Island, [head of Delaware Bay] from N.N.E. to N.W. Now these places were nearly in opposite sides of the storm; the wind was therefore centripetal, as it blew from each towards the other." p. 150.

This is another example of the confusion of data above mentioned. The "*same time*" meaning only those long continued and undistinguishable portions of time, in which two ships "had the wind blowing a gale from E.S.E. to S.S.E., and at Philadelphia and Reedy Island, the whole time in which the gale was blowing and veering "from N.N.E. to N.W."! But if "these places were in nearly opposite sides of the storm," and "it blew from each towards the other," then we may suppose it to have blown from New York to Philadelphia, thence to Reedy Island, from this to the ships off the Jersey coast, and from the ships towards New York; while the natural current of S.W. wind at Norfolk was following after the storm. I might make a further analysis of this passage, but think it unnecessary.

The setting in of the N.E. wind at New York, requires, however, a distinct consideration. I had comprised the various reports from this city in my general statement, "from N.E. to E." One or two accounts say N.E., as does the report from Jersey City; while at the Quarantine at Staten Island, five miles below, where the direction would be most likely to be known, it is stated at E.S.E. or E. A majority of the city accounts which I have seen, also fix the onset of the gale from E. or E.N.E. It is only by a comparison of such reports that we can arrive at a reasonable conclusion, and the mean of all the accounts published at that day would be E. by N., probably near the truth. Mr. E. himself gives an account stating it at "E. S.E., veering to E. and E.N.E.," and another which fixes it at E. (p. 157;) and he can hardly be justified, therefore, in assuming it at N.E. But we have other facts which remove all doubt on this point. Of the ships at or near the quarantine, one* or more was driven up the kilns, between Staten Island and Bergen Point. Also, the Hoboken ferry boat, which, after repeated trials, nearly reached the city, was blown off and reached the shore near Col. Stevens' (Hoboken.) (N. Y. Gaz. Sept. 7.) These facts cannot be reconciled with a N.E. wind. I may add here, that it is not uncommon to find errors of this kind made at New York; occasioned, perhaps, by re-

* Ship Chase.

ferring the N. point to the course of the North River, or to Broadway, which are about N.N.E. and N.E. by N., respectively.

We are next told, that "while the storm was passing over Connecticut, the wind blew *constantly* in the S.E. corner from the S.E., while *at the same time*, in the N.W. corner of the state, the wind was blowing a furious gale from the N.W., and Mr. Redfield himself testifies, that the 'trees and corn in this corner of the state were uniformly prostrated towards the S.E., while even as far inland as Middletown, they were uniformly prostrated towards the N.W.'" p. 150, 151. The italics are mine:

We have here a further combination of errors, of a like character with the preceding. 1. In assuming that the wind blew "constantly" from the S.E. in the S.E. corner of Connecticut; for the gale here set in at S.E. or S.S.E., and veered round by S. as it passed over; a fact well known to me from the beginning, but not noticed in the newspaper accounts of the storm. 2. The "furious gale from the N.W." "in the N.W. corner of the state," was not as strong as the earlier S.E. gale in the central part of the state, and did not blow "at the same time" that the gale was south-easterly about New London; but at a later period, when the central portion of the storm had advanced into Massachusetts, and the gale had ended on the southern shores of Connecticut. 3. It was a north-easterly wind which prevailed in the N.W. corner of this state, "at the same time" with the south-easterly wind on its S.E. border; and being a retrograde wind, minus the progressive velocity of the storm, as well as exterior to its severest action, it caused little prostration; this effect being chiefly produced by the closing wind from the N.W. quarter, on the cornfields, after the S.E. portion of the storm had passed from Connecticut.

On these points I feel it to be right to speak with that confidence which a knowledge of the facts inspires: having spent several days in Berkshire county, Mass., immediately after the storm, and having also traversed its field of action, on different routes, for more than 60 miles, on a course transverse to its line of progress, and for 40 miles in the opposite direction, at the time when the facts of the case and the effects of the storm were fresh in existence, and in the minds of every observer. My original account in the American Journal of Science, from which it is now attempted to force a conclusion in favour of the centripetal theory, was couched in very general terms, having reference not so much to distinctions of time and exact direction, as to other considerations of a more general character; and the use of the qualified phrase, "*about* the same *period*," was then thought sufficient to prevent such a misconstruction as is now attempted, in support of a newly conceived theory.

We find in the two succeeding paragraphs, (p. 151,) that Mr. Espy has fallen into a similar error, by assuming, once more, that the S.E. and N.W. winds noticed in Connecticut, and also a S.W. wind which one account states to have followed or closed the storm at New York, were simultaneous parts of the gale, blowing in a rectilinear direction towards a point westerly of Middletown. The error, I believe, has been sufficiently exposed. In the next paragraph, he says: "We have no account how the wind blew to the N.E. of the point in Connecticut, towards which these currents blew, but as the wind set in from the N.E. in front of the storm, wherever we have any account, [?] it is highly probable that here too the wind was blowing from the N.E. at the same time." p. 151.

The last fact assumed here, is perhaps one of the grossest errors that I have been called to notice; as will be obvious I think to every one who ex-

amines the various accounts of this storm. Its commencement from the S.E. quarter at Hartford, Springfield, and Worcester, as well as other places "in front of the storm," I should think could hardly have escaped his research: but lest he should attempt to reject these, I quote the following, from a locality which appears to be N.E. of the point above alluded to.

Northampton, Mass., Sept. 5. A heavy storm of wind and rain from the S. and S. E., passed over this town on Monday evening last. One of the court house chimneys was blown down, and a barn belonging to Mr. Enos Cook. Considerable injury was done to orchards; trees were uprooted or shattered to pieces. Cornfields are prostrated.—*From N. Y. Gaz., Sept.* 13.

The S. wind first mentioned here, I presume to have been the fresh southerly wind which immediately preceded the gale, and which passed over Connecticut, heavily charged with condensed vapour, or sea scud, such as not unusually produces rain higher up the country. The direction of the gale here, as well as throughout this region, appears destructive to the above centripetal hypothesis.

We have seen from the foregoing, that this storm did not "blow inwards" from "its borders towards its central parts," as Mr. Espy next alleges; but circuitously, in the manner of a great moving whirlwind, and revolving constantly around its progressive axis in the direction from right to left, or contrary to the hands of a watch which lies with its face upward.

We next find, that on closing up his allegations Mr. Espy does "not say that the wind blew to one central point from every part of the circumference;" he says "this is hardly to be expected, even if the storm was perfectly circular, for reasons too obvious to require explanation." p. 151. I agree most entirely in this conclusion: but which was probably intended only as a qualified indulgence to his theory—an indulgence which he no where allows to the whirlwind storm. The probable origin of this concession I may have occasion to notice.

Mr. Espy next considers it "almost certain that the diameter of the storm was longer from S.W. to N.E. than from S.E. to N.W.," and estimates the former at "more than 300 miles;" and that the diameter from S.E. to N.W., when the storm reached Connecticut, certainly was not more than about 100 miles—for at Providence it was not of a violent character, and about 50 miles N.W. of that city, the centre of the storm passed, so that here its semi-diameter was only about 50 miles." p. 151.

We have already seen evidence of the incorrectness of this conclusion; and it is not long since Mr. Espy pronounced a storm which was more irregular in its development, as being "so nearly round that it would be an affectation of accuracy" to consider it otherwise.* We have also found a S. E. wind reported at Northampton, which place, "as the crow flies," is more than 70 miles from Providence; not having yet reached the line of N.E. wind which he assumes for the centre of the storm. This inquiry is not for the violent portion of the storm, but for its extreme width; and we have already found its extreme border to have been far eastward of Providence, at which place its violence was sufficient to prostrate trees and buildings, a rope walk among the number. On the other hand, I find it stated that the steamboat Chancellor Livingston was detained no less than

* Journ. Frank. Inst., Oct. 1838, p. 225.

four hours by the gale at Poughkeepsie, which is 80 miles up the Hudson. We have thus a great addition to Mr. Espy's dimensions in this direction; and if we estimate its extent N.E. and S.W. by its duration at Norfolk, Capes of Delaware, and New York, where he claims *the centre* of the storm to have passed, it will afford little evidence of the elongation in figure which he has attempted to show.

We next find Mr. Espy resuming his aerial speculations; with which I have no wish to interfere. The averment that the "hypothesis of a whirlwind" does not explain the cause of the rain and hail, is both unphilosophical and foreign to the issue of fact in which he has joined. The attempt to find a universal solution of nearly all atmospheric phenomena, in the theory of aqueous condensation, in the present state of our knowledge, appears like "advancing backward" towards the dark ages of meteorology and other sciences:

The attempt which is next made to press Dr. Mitchell's prognostics, quoted by me, into the service of the centripetal theory, is an example of the facility with which Mr. E. causes nearly all atmospheric phenomena to perform the same service.

"When a haze or cirrus is seen [from New York] over Staten Island at S.W. or more southerly, [say S.S.W. and S.] the storm of the succeeding day will blow from the *north-east*, but if it appears over the Jersey shore of the Hudson from W.S.W. to N.W., then the storm is expected to blow from the S.E. From this it would appear that the wind blows towards the cloud of an approaching storm." p. 153.

Thus, if I understand Mr. Espy, when the cloud first seen southward of New York has moved 12 or 18 hours in a N.E. direction, so as to be found over Massachusetts Bay, or farther distant, and the great body of the storm is spread over the ocean, nearly opposite New York, *then* "it would appear" that the N.E. wind at the latter place "blows towards the cloud of an approaching storm." (!)

The observation ascribed to Dr. Thomas, of North Carolina, on the longitudinal extent and appearance of certain thunderstorms, as they appear in the western horizon, and their smaller extent from S.E. to N.W. is such as must have been often made by every observer. These appear to form on a line of disturbance or disruption, where a portion of the lower wind becomes connected with, or is broken by, a colder, or higher, stratum. But I am at a loss to determine what analogy or connexion these appearances can have with the storm of 1821, or with others of a like character. This attempt at analogy appears as remarkable as the avowal which precedes it, (p. 153, line 8, 10,) that all "phenomena connected with storms" "are explained by the evolution of caloric in condensation of vapour," an avowal well suited to the ultraism of Mr. Espy's calorific theory.

Mr. Espy having closed his "investigation" of my storm of 1821, in his capacity of meteorologist of the joint committee, and after claiming both fairness and demonstration as pertaining to his deductions above noticed, adds the following, which perhaps is intended as an additional "demonstration."

"Moreover, as the wind on the S.E. side of the storm had been blowing all day, before the storm came on, from the S.E., and on the N.W. side of the storm from the N.W., there appears no reason for the motion of the storm from the S.W., but the uppermost current of the atmosphere, which is known to be always moving in this direction." p. 158.

So far as I know, we have never learned that "the uppermost current of

the atmosphere" is always moving from S.W.; or that any observations have ever been made upon its movements. We know from ocular demonstration, as well as from other indications, that *several* horizontal currents are usually, if not always, manifested in the atmosphere, pursuing their several courses, sometimes over vast surfaces, one above another; but it is only the lower and denser of these currents of which we can often take cognizance. But, if by "the uppermost current," be only meant those currents which usually prevail in the common region of the clouds, then the *known direction* here asserted, requires much qualification. For, having made more numerous and longer continued observations upon this subject, recorded daily, than have yet come to my knowledge from other sources, I am able to say that these *currents* usually prevail, in this region, between S. W. and N.W.; and in the greatest proportion from about W.S.W.

Nor do I perceive what influence an "uppermost current" could have in driving forward this storm. The "evolution of caloric in the condensation of vapour," both before and during the storm, having apparently been confined to the lower atmosphere or wind, the course of the storm, upon this theory, I should think, ought to have been with the south-easterly wind which is so generally reported previous to the access of the gale, and which appears to have prevailed beyond its borders. Besides, an upper current in the region spoken of, as may be often seen, and is recognized by Mr. Espy, appears to produce no appreciable effect upon the course or velocity of the wind, or stratum of atmosphere moving below it. I can see no reason, therefore, why the "uppermost current" should govern the course of the storm; unless, indeed, it were to encounter the vast ideal spire, or ascending column, which Mr. Espy erects in the centre of his centripetal storm. But of this we can perceive no evidence in the undisturbed movement of the higher stratum, which is often witnessed for days before and also immediately previous to the arrival or passage of the centre of the gale; the placidity of which higher current appears to remain undisturbed. Moreover, according to analogous statements of Mr. E., the top of this spire should perhaps be considered as being "blown off," or else spreading out, like a great mushroom, in space which was already occupied by these higher currents!

In my first paper, I attempted to indicate, in a general manner, the causes which must govern the course of our great storms, as being found in the *general course of the great inferior currents of wind*, of which I considered the trade winds as forming an integral portion.* The general course of the aerial currents at the common height of the clouds, is here deemed important, only so far as it may indicate the *generally uniform course of the inferior atmosphere*, separated as these higher currents are, from obstructions and deflexions, the eddyings or gyrations, as well as retardations, which pertain to the surface winds which lie at the very bottom of the aerial ocean. But it appears from my long course of observations, as well as from facts stated elsewhere, that an upper current of wind can have but litte influence upon the course, or blowing direction, of the mass or stratum of wind lying beneath it, as before noticed.

I may here notice, that in his "Examination," &c. in the Jan. No. of this Journal, Mr. Espy speaks of the known S.E. direction of the upper wind, flying above the trade winds in the West Indies, (p. 49) but what is the extent or foundation of this knowledge does not clearly appear. Is it

* Silliman's Journal, April, 1831, vol. xx. 50 51.

founded only on the known courses of the storms in that region, which I had pointed out? It may be possible that Mr. Espy has not well acquainted himself with the various directions and anomalies of the trade winds in those regions; especially with the general movements of these winds as exhibited below the medium height of the clouds: although I admit, that the very lowest or *surface* current of these winds, is most frequently north-easterly. But that which he appears to call "the uppermost current," has, in those latitudes, been generally reported from the S.W. quarter; and as a mere *upper current*, let me add, would be as likely to control the direction of these storms while in the West Indies, as in the United States.

Although unpractised in controversial discussion, it has been my design, in this defensive appeal, to treat Mr. Espy's pretensions with fairness, as well as with particularity; such as the importance of the issue appears to demand; and I have regretted that he did not consider it desirable to confine the discussion to a few of the most important and distinguishing facts and characteristics which are alone necessary to a decision of the question.

It appears to have been established by my inquiries, that there is a line pertaining to the interior path of a violent storm, on one side of which, the changes presented in the direction of the wind are in the order from left to right, coinciding with the apparent course of the sun in northern latitudes: while, on the other side of this line, the order of change presented by the wind is against the sun, or from right to left. Now, if on and immediately contiguous to, this line, the direction of the gale previous to its crisis and change of direction, be found opposite to the course of the storm, i. e. in the direction which is retrograde, but parallel to its line of progress, in accordance with the centripetal theory, then the case must go for Mr. Espy. But if the direction of the wind on and near this line, previous to the crisis and change of the storm, be found in a direction which is *transverse* to the general course of the gale or its line of progress, in conformity with the theory of a whirlwind, then the *rotary* action of the gale is established. The approximate accuracy with which the line of the axis or pivot of the storm, may sometimes be fixed, and the extremely divergent character of the winds here specified, render the question, in such cases, of easy determination; and for testing the two theories, it was unnecessary to extend the inquiry or discussion beyond this single and tangible point.*

There is still another and conclusive test for the two theories in their application to storms. It must be obvious, that if Mr. Espy's centripetal theory be the true one, then the various directions of wind in a storm will as well correspond with a whirlwind turning to the *right*, as with one turning to the *left;* and one course of rotation can as readily be made out from the facts collected, as the other. Now, I invite Mr. Espy to apply this rule of examination to the storm of 1821, and also to the various storms which are noticed in the work of Col. Reid. True it is, that on the whirlwind theory, this other result would require every wind to be reversed in its direction; but, if Mr. Espy is right, no such reversal will be necessa-

* This test will apply equally to the traces or prostrations in the paths of tornadoes; or, if these be the effects of a wind blowing from all sides directly towards the centre of the tornado, then the predominant effects of the wind *in the centre of its path*, will be found *parallel* to its course;—but if the effects here, be *transverse* to the line of progress, then the prostration was occasioned by a whirlwind: no matter in which of the transverse, or longitudinal, directions the effects may have been produced.

ry; for in such cases the reported direction of the several winds at various places will be found to correspond as well with one direction of rotation as with the opposite; both being equally remote from his centripetal theory.

Let the advocates of the latter, who remain unsatisfied, make this trial, with our figures before them.*

An argument for the theory of rotation may be found in those sudden irregularities and in the light and uncertain winds which are sometimes exhibited near the centre of a storm; for, on the centripetal theory, the relative condition of this portion of the storm would appear liable to little change. But, in a whirlwind storm, the winds will be found to have an axis of *progression*, as well as an axis of rotation. These axes cannot coincide in their path, but the former will be found considerably to the left of the latter, or on the coast of the United States, further to the N.W. We see here a cause for many of the anomalies and irregularities of action which are found near the centre of a gale; and which, according to the centripetal theory, would not be likely to occur.

Another argument for the whirlwind theory, is found in the increasing and sometimes very extensive expansion of the lull of the storm, particularly in greatly extended storms, where the passage of the central lull, and the continual depression of the barometer, is sometimes of more than a day's duration. This appears to be due to the centrifugal influence of the rotary action; but it is difficult to perceive how this enlargement of the central lull under a continued barometric depression, can be reconciled with the centripetal theory.

In comparing the accounts of the storm of 1821, the inquiring reader will hardly have failed to notice the unequal force and duration of the westerly winds which closed the storm, as compared with the more generally violent and longer continued winds from the eastern board. This peculiarity frequently attends the development of our coast storms, which sweep, as in this case, partly over the sea and partly over the land; and seems to be due to the greater obstructions which are offered to the gale by the continental surface. The results seem accordant, however, with a generally circuitous action; these westerly winds, at least the south-westerly, being often found strongest at a distance from the coast.

Observations made on well developed storms of a later date than that which has been considered, have shown the distinguishing characteristics of the whirlwind storm. On the line of lull in the centre of the storm, the wind has been observed to set in, not contrary to the course of the storm, according to Mr. Espy's theory, but more nearly at right angles to this course, and continuing with increasing violence in nearly this direction, till the arrival of the lull; after which the wind commences to blow, more or less suddenly, from nearly the opposite point of the compass, and continues in that direction till the close of the gale. Such was the storm of April 28th, 1835, at New York, on which observations were made with great care. These and like observations would appear to be entirely conclusive of the question.

I have never known a storm in which the line of the central lull has corresponded to that of an initial wind blowing opposite to the course of the storm, and the lull followed by an equally strong wind from the opposite

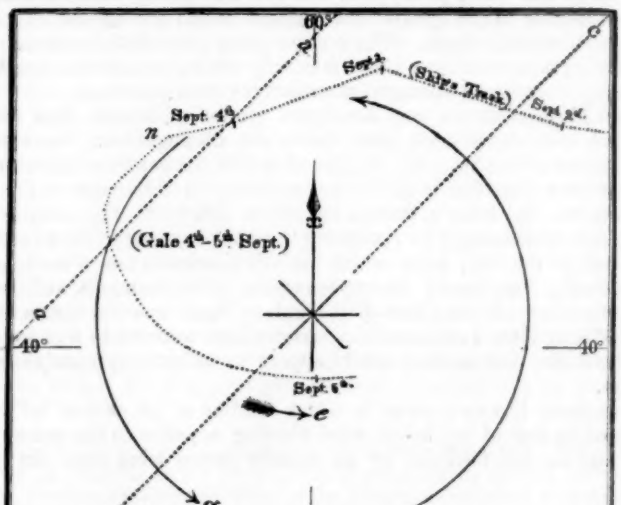
* The facts necessary for this examination, as relates to the storm of 1821, are found in this Journal for March, 1839, p. 153—158. This test is too important to be omitted by those who remain in doubt on this subject.

quarter, blowing parallel to the progress of the storm; nor am I yet prepared to believe that such a case can be produced.

In illustration of the rotary character of the Atlantic gales, I present here the case of a N.E. gale which was encountered at sea on the 4th of September last, off the Sable Bank. This storm, like three others which immediately followed, passed at sea, not far from our coast, and apparently on a track leading far to the northward. The account was kindly furnished by Thomas H. Sumner, Esq., master of the ship Cabot, and was drawn up by him soon after the close of the gale. At noon on the 4th, the ship's latitude by double altitudes, was 42° 12′ N., lon. 61° 5′ W., ship steering W.N.W., and the wind at N.E., soon increasing to a severe gale. At 4 P. M., reduced to close reefs. The gale had now so increased that it was deemed hazardous to heave too, and the ship was kept before the wind; which gradually hauled to the N. At 11h. 30m. P. M., it was a perfect hurricane. At 2 A. M., [6 A. M.?] the wind had hauled round to W.N.W., and at 2 P. M., the storm had so far abated that the ship resumed her course. Lat. at noon on the 5th, 39° 39′ N., lon. 59° 59′ W. The following are the approximate courses from the log book from noon on the 4th, to noon on the 5th, corrected for variation.

Courses.	Hours.	Distance.	Courses.	Hours.	Distance.
W.b. S.	4	40 miles.	S.E. b. S.	2	22 miles.
W.S.W.	1	10 "	S.E.	2	21 "
S.W.¼W.	4	44 "	E.S.E.	2	20 "
S. b. W.	1	11 "	E. b. S.	4	40 "
S. b. E.	2	24 "	E. b. S.	2	18 "
					250 miles.

The winds during this period, as since taken by me from the log-book, were N.E., N.N.E., N., N.N.W., N.W. b. W., W.N.W., and W. b. N.



I annex here a figure showing the track of the ship previous to, and dur-

ing, the gale. The line *a a* will represent the general route of the centre of the storm, according to the centripetal theory, but, viewed as a whirlwind, the centre may have passed near the line *c*, c. In plotting the courses, an approximate correction is made for the angles resulting from a reference of the course to the points of the compass, and also, for the heading off and continued set of the Gulf Stream. The curved wind arrows are drawn from a fixed centre, but owing to the continued progress of the centre with the body of the storm, it may be presumed that the direction of wind represented at *d*, would, from this cause, have been carried forward in its position; as for example, at *e*, or to a more advanced position.

Had the N.E. wind here, been at or near the centre of the storm according to the centripetal theory, not only would the ship have been met, perhaps after a lull, with a violent wind from the S.W., but a large portion of the ship's track, from 4 P. M. on the 4th, would probably have fallen under the *easterly* winds, which, upon this theory, belong to the opposite portion of the storm; by which the ship would again have been driven to the westward. But the continued curvature of the ship's track, while running before the wind for so great a distance eastward, appears to demonstrate that the storm was of a rotary character, whirling to the left.

Did our space permit, I might here notice in a more particular manner, the "examination" of Col. Reid's work which Mr. Espy has attempted in the January No. of this Journal. The survey which has here been taken of his examination of the storm of 1821, may serve, however, to illustrate the extent of his misconceptions in analogous cases. We are also furnished by Mr. E. himself, with a key to the illusion under which he appears to have fallen in regard to these storms. He says:

"On reading the logs of the several ships, I kept the map of the particular storm open before me, and drew my pencil across the point where the ship was, drawing an arrow so as to exhibit to the eye which way the wind was blowing at that time in that locality. When several logs were read, and arrows made in every locality, I was not a little pleased to see, in all the storms, decided proofs of an inward motion of the air." January No., p. 39.

This fallacy is also brought before the eye of his reader, in various figures inserted in the same paper, and appears to have had a controlling influence upon his mind from the beginning of his inquiries.

Perhaps it is not generally understood, that the traces of the action of an ordinary whirlwind, as found in the prostration of corn, and other objects, along its path, always point inward, and at first view appear not greatly unlike the action of two parallel lines of opposing winds blowing simultaneously towards each other. From causes which I think are obvious, this effect is more strikingly exhibited in small tornadoes, than in large storms of the whirlwind character; but the *coup de œil* of the effects marking the various and successive directions of the wind, when thus blended together, is, in the latter case, not unlike the former. But a careful analysis of these effects, with proper attention to the order of time, place, and succession, will not fail to demonstrate a circuitous or whirling action.

These effects were well exhibited in the track of the New Brunswick tornado, (N. J.) of June, 1835; and which corresponded to those which I have examined in the tracks of several other tornadoes of like character: and if there be any effects which amount to a demonstration of a constant whirling movement in the wind, they are certainly to be found in these appearances. Small whirlwinds, exhibiting like traces, have sometimes passed

under observation and the entire circuit of gyration been fully taken in by the eye. These peculiarities of aerial motion have been noticed from time immemorial, and have been clearly designated by terms which seem to have found their way into all languages, through all ages. But according to the discoveries of Mr. Espy, founded, perhaps, on these inward appearances, the observations in all ages, on which these terms have been founded, could have amounted to little else than an ocular deception; and an obvious whirlwind can be no whirlwind, after all! but, strange to say, the wind in such cases has blown from all sides, almost, if not directly, inward,—each part opposing every other part in its onward motion, until compelled, for want of room, to turn directly upward in an ascending column; or, perhaps, I should say, *drawn* upward by a principle of calorific levity! To say nothing here of the physical impracticability of continued movements of portions of contiguous atmosphere in opposing directions, I would suggest to the advocates of this centripetal theory, to inquire whether these inward appearances, on which they rely, are not the necessary results of whirlwind action, and such as are uniformly exhibited in the path of destructive whirlwinds? Notwithstanding the illusion of these inward appearances, it will be found that each single effect, when plotted in connexion with other effects which were produced *at the same instant of time*, may serve to demonstrate the whirling action.*

The great mass of interesting facts, and the clearness of the illustrations found in the work of Col. Reid, are such, however, as will probably carry conviction to all minds not preoccupied by opposing theories or opinions: and it is not probable that the valuable developments of the law of storms which are found in his work, can be obscured or set aside by the opposing views and labours of his ingenious but mistaken examiner.

It was my intention to have introduced here, some further remarks on the errors or fallacies which are apparent in Mr. Espy's reports on various other storms, as chairman of the joint committee on meteorology; but the space which has been already occupied, renders it necessary to relinquish this design. I would however, notice in passing, that his selection of these storms has not often fallen upon those of a strongly marked character and in such a field of action, as would leave little room for mistaken or imaginary inferences; that in no case, save the last reported, has the collection and development of the facts, been such as the character and objects of the committee seemed to demand; and that in nearly all of the *twelve* cases, thus put forward and relied on by Mr. Espy, there has appeared, on examination, sufficient evidence for the refutation of his peculiar positions.

The most important and creditable of these labours of Mr. Espy, relate to the two storms which simultaneously visited our sea coast and interior, on or about the 17th of March, 1838. This coast storm Mr. E. has blended with the fall of snow and rain which appears to have prevailed over a large interior portion of the United States at the same period, attended by no remarkable development of wind, and a like moderate effect upon the barometer; and which, on its arrival near the coast, appears to have blended with the smaller and more strongly developed storm or gale which was then sweeping along our seaboard. The latter, favoured probably in the action of its north-western limb by the diffusing and concurrent action of the in-

* I do not here notice the involuted spiral course of the wind inward and upward, in these tornadoes; not deeming it necessary to the illustration of the points now at issue.

land storm, exhibited its N.E. wind with unusual violence. But in place of the continued and strong north-westerly wind, which, in regular and well developed storms, immediately follows, *the barometer remained depressed, and no westerly gale followed.* But in the few marine accounts given by Mr. Espy, the development of a westerly gale on the opposite limb of the coast storm, off at sea, was clearly distinguishable; with other marked characteristics of a whirlwind storm.

These general conclusions, I think, will be obvious from even a cursory examination of Mr. Espy's chart and evidence illustrating this storm, at least to those who are accustomed to examine the phenomena of the whirlwind storms; and it will readily be seen, that the violent N.E. gale near the seaboard, was of a different character from the more general inland storm; as is apparent also from the greater fall of the barometer near the coast; which is always found to be greatest near the true centre of the gale.

There are two important facts connected with the development of this storm, as exhibited by Mr. Espy, which have strong claims to the attention of those who advocate the centripetal theory. The first is, that the collection and arrangement of the evidence relating to the course of the winds and their delineation upon the map, has brought Mr. Espy to acknowledge "that there is no one point at which all the arrows, if prolonged, would meet;" one arrow pointing to "somewhere in North Carolina," and another to "somewhere near the N. part of the storm."* He would fain believe, however, that certain of the strong exterior winds would meet "very little S. of the centre," and in conformity with his theory. But it is difficult to see how this storm, as developed by him, can afford any support to his peculiar views; and he obviously overlooks the connexion of the N.E. wind, E. of the Alleghanies, with the storm which was sweeping along the coast, and which was made apparent by a report of the gale at W.S.W., two and three days before arriving at the Capes, by the ship Sabina, at Philadelphia.

It is a fact equally remarkable, that if we set one foot of a pair of dividers upon the central point which Mr. Espy has marked for the storm of the 17th, and, with a pencil at the other foot, sweep through the several geographical points in and near the field of his storm, W. of the Alleghanies, we shall then find that the direction of the wind in the places from which reports are given, appears to correspond with *a great circuit, or whirlwind, turning to the left.*

Now, when we consider the diversity of surface and position in this great inland region; the distances and the inequalities of elevation, which in some cases might expose the locality to the action of other strata of winds; and the disturbance of direction which possibly might have resulted from the contiguity or influence of the violent coast storm, together with the liability to inaccuracy in the reported observations; this result may well be considered not only as remarkable, but of great value.

The reader is invited to test the examination in the manner mentioned, at the following localities, as they are numbered on the chart which Mr. Espy has attached to the report under consideration, viz.

Locality No. 6. On the 16th and 17th March.	Locality No. 14. On the P.M. of 17th.
Locality No. 7. On the 16th and forenoon of 17th.	" 15. " 17th.
	" 17. " 17th.
	" 18. " 17th.

* Journ. Frank. Inst., Oct. 1838, vol. xxii, p. 224.

Locality No.	11.	On the	17th.	Locality No.	20.	On the P.M. of	17th.
"	12.	"	17th.	"	27.	"	17th.
"	13.	"	17th.	"	28.	"	17th.

These, I believe, comprehend *all* the reports from localities within or near his field of the storm for the 16th and 17th, except that portion which falls within his circle for the storm of the 18th, which is omitted for the reason specified. In three of the above cases only, is it found necessary to make a distinction between the winds of the morning and evening, and if the whole were to be referred to noon on the 17th, it is not improbable that the coincidences would be entire. The most divergent direction of the wind from a circle which I have here found, according to the wind arrows on the chart, comes very much nearer the circuitous or whirlwind movement, than towards the central point marked for the 17th, or any other approximate geographical centre. It should be remembered, that these localities are scattered over a range of country extending from near Lake Ontario to the northern extremity of Alabama, and from the Alleghany Mountains to the middle portions of Indiana.

If we now examine, by a like test, the reports from localities which remain in the field assigned for the storm on the 18th, we shall also find a large portion of cases in which the direction of wind conforms, mainly, to an axis of rotation moving eastward along the coast. But as these reports relate chiefly to the storm of the seaboard, with which the land storm had become blended, I forbear to enter upon a more extended analysis.

We cannot suspect Mr. Espy of having developed these facts for the purpose of sustaining the whirlwind theory of storms; and these results, though still imperfect, may serve to show the value of careful and widely extended observations, when collected and brought into view, as in this report. Ill chosen, as I think was this storm, for the object of deciding the important question which Mr. E. has raised, yet the facts thus obtained and developed in relation to a complicated and somewhat anomalous exhibition of weather, such as is not unfrequently found in these latitudes, are none the less valuable in meteorology: and I hope to see many such efforts on the part of Mr. Espy and the able committee to which he acts as meteorologist. I will only add here, that I have been able to collect additional information relating to the above storm; having extended the inquiry in various directions at sea, as far eastward as the bank of Newfoundland.

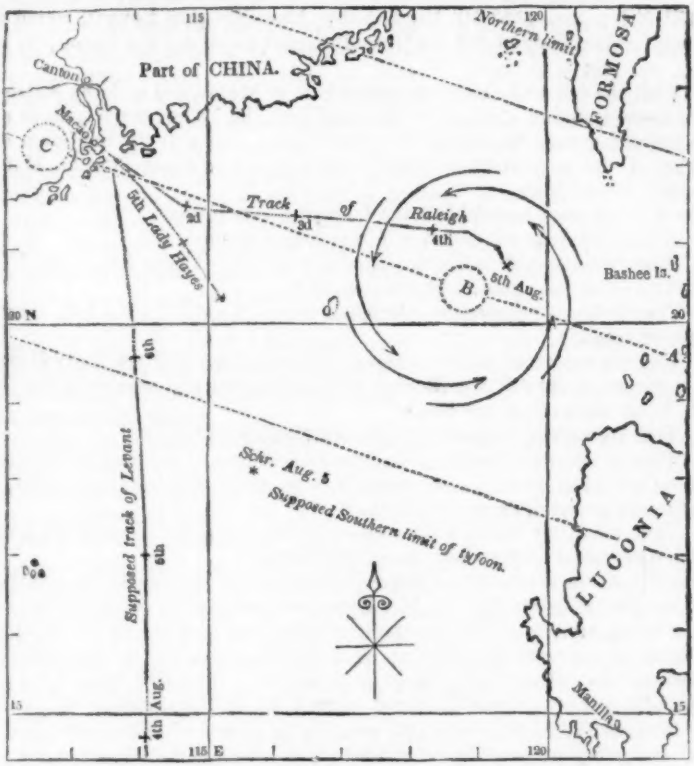
New York, May 18, 1839.

POSTSCRIPT.

Since the above was sent to press, the continuation of Mr. Espy's examination of Col. Reid's work, &c. has appeared in the April number of this Journal. The character of this additional matter appears, however, to correspond so nearly with that relating to the storm of 1821, which we have now reviewed, as hardly to require any further reply; except as the present opportunity may seem to invite a passing notice. In his further notices of Col. Reid's storms, we again observe the continued blending of the phenomena which pertain to different periods of a storm, into one forced connexion, as if occurring at the same moment of time, and which is best refuted by the reading of Col. Reid's book, and an attentive consideration of the facts which are there recorded.

In copying my evidence respecting the Raleigh's tyfoon in the China Sea, which had also been noticed by Col. Reid, Mr. E. has neglected to

present his readers with the geographical sketch by which it was accompanied; which is here inserted. By referring to this map, in connexion with the annexed synopsis of the evidence, the reader may determine for himself the rotative character of this hurricane: although Mr. E. confounds with the regular action of the storm, the light N.W. wind which preceded the gale at Canton, and the S.E. wind by which it was followed.*



From the evidence which I have collected relating to the storm, we arrive at the following facts:

1. That the Raleigh met a gale which set in with the wind at N., veering round by the E., to S.E. and S.

2. That at the harbours and roadsteads inside, (Macao, Kumsingmoon, &c.) as well as at Canton, the gale occurred at a later period, and the wind also set in at N. and *veered* to E. and S.E., in a manner similar to that reported by the Raleigh.

3. That with the ship Lady Hayes, off the islands at the mouth of Canton river, the wind also set in at N.; but the ship steering S.E. by E. under a

* On this map, the track of the Levant was laid down by estimate, before Captain Dumaresq's Journal was received, and should have appeared somewhat further to the westward. The position of the Levant at noon on the 6th, was a few miles N.W. of the position indicated on the map.

press of sail, (and doubtless falling off from this course with the heavy sea from the eastward,) the wind, towards the middle of the gale, began to veer towards the W., whence it drew round to S., towards the close of the gale.

4. That the violence of the wind was greater with the Raleigh than with the Lady Hayes.

5. That the gale was experienced by an English schooner, August 5, in lat. 18° 2′ N., lon. 115° 50′ E.: but the American ship Levant, which arrived in Canton river on the 7th, from the southward, did not encounter the gale.

6. That the fall and rise of the barometer at Macao and with the Raleigh, and the strength and changes of the wind with the latter, were such as are often exhibited near the centre of a hurricane; and that the minimum depression of the barometer occurred about *seventeen hours later* at Macao than with the Raleigh.

These facts seem to establish the following conclusions:

1. That the tyfoon advanced in a westerly direction.

2. Negatively;—that it did *not* pass through the China Sea, from N.E. to S.W., nor on the opposite of this course.*

3. That it was a *progressive whirlwind storm*, turning to the *left*, around ts axis of rotation.

4. That its centre of rotation passed to the *northward* of the Lady Hayes, and to the *southward* of the Raleigh and of Canton; and nearly on the line A, B, C, as marked on our chart.

5. That its rate of progress was about 17 miles per hour.

6. That the extent or diameter of the violent part of the gale, as deduced from its duration and rate of progress, was about 400 nautical miles, or equal to six or seven degrees of latitude.

7. That the latter induction accords with the geographical evidence which has been obtained of the visitation of the storm.†

The fall of the barometer in these storms, I have considered as resulting from their rotative action; but Mr. Espy here asserts that it cannot be due to this cause, and for proof, he refers us to his speculations on this subject. But facts are more to be relied on than speculations, and as furnished by himself, on several occasions, they appear to be conclusive against his position. He asserts, "that it would require an *outward* motion of the air from the centre, of 240 feet per second, to make the barometer fall an inch;" but every person who has observed the action of a vortex, and the depression which the rotary motion occasions at its centre, may know this to be an error, and that no such *outward* motion is necessary for diminishing the central pressure.

In professing his acceptance of the test which I had suggested for his theory, as applicable to storms in the West Indies, and to those moving N. E. on the coast of the United States, Mr. Espy wishes me to concede, that when "the wind sets in at N.E. in storms on our coast, it never can change round to N.W.," which change he asserts to be irreconcilable with the whirlwind theory. But this cannot avail, for such changes, which every observer has noticed, certainly cannot be considered as sustaining his centripetal theory. This appears, however, to be the most plausible of his

* A writer in the London Nautical Magazine had ascribed a S.W. course to this tyfoon.

† Vide Silliman's Journal for January, 1839, vol. xxv., p. 209—219; or London Naut. Mag. for January, 1839.

positions, and is grounded on his confident, but impracticable, reference to the "*extreme border*" of a storm, which has already been noticed. There is, evidently, much relating to this matter which Mr. E. fails to comprehend. It is obvious, however, that when a great gale has "set in" at N.E. on our coast, the "extreme border," or influence of the storm in the atmosphere, has already advanced far beyond the observer: it may even have advanced to the distance of some hundreds of miles; as has been seen in illustrating the phenomena which were noticed by Dr. Mitchell.

It had been well for Mr. Espy, if, in applying the proposed test to storms on this coast, he could have found one storm which would have sustained his centripetal theory. He refers us, indeed, to the "numerous examples" which he had already given in the storm of 1821, as "harmonizing" with his theory; but with the true character of this harmony, the reader is already acquainted. In further seeking for facts to sustain his theory under this test, instead of taking cognizance of storms, "as they move in a N.E. direction along the coast of the United States," according to its terms, he has only referred us to certain facts, (perhaps anomalous) relating to Col. Reid's storm of the middle of August, 1837, which are derived from the log books of the Ida, Rawlins, Yolof, and Duke of Manchester; facts which occurred on and near the latitude of 30°, where the storm is rapidly changing its course of progression, and which are therefore inapplicable to either branch of the test which I had presented. I can see no reason, therefore, why these cases should have been adduced, except for want of better, while it can readily be shown that these selected cases are quite at variance with the centripetal theory.

It had also been fortunate for Mr. Espy, if in accepting the test for the storms in the West Indies, he could have furnished one clear instance of a hurricane's blowing from W.N.W. or N.W. without material change, until the appearance of the central lull, and then, resuming its violence from the opposite or S.E. quarter, till the close of the gale. If his theory of centripetal storms had been well founded, it would have been easy to have produced at least a dozen such cases. But, when the generalization made by Edwards at Jamaica, that "all hurricanes begin from the N., and veer back to the W.N.W. and S.S.W."—and that "when got round to S.E. the foul weather breaks up,"—is gravely adduced by Mr. Espy, with other facts of like character, as fulfilling the conditions of the test which I had proposed, it becomes evident that there are no facts to be found which can sustain his theory. It may be seen by referring to our figures in the early part of this communication, and adapting them to a *north westerly* course of the storm, and also by our map and figure relating to the storm in the China Sea, which pursued the same direction, that the setting in of the hurricane at N. in the latitudes of the West Indies, and its *veering* from that point round to W.N.W., and so on through S.S.W. till it ends in the natural current from the S.E. by which the storm is driven forward, is entirely at variance with his centripetal theory, as applied to the centre of the storm's path in these latitudes; while the direction and changes above described are in full accordance with the other facts by which these hurricanes are proved to be great whirlwinds, spinning to the left, and advancing, in the latitudes referred to, in nearly a W.N.W. direction.

I have reason to hope that the expositions which have now been given, will tend, in some degree, to quiet the apprehensions expressed by Mr. Espy in relation to those rules for the practical navigator which are founded, not

on a mere theoretical basis, but on those important *facts* relating to storms, which have recently been brought into view.

Bibliographical Notice.

Popular Lectures on Geology, treated in a very comprehensive manner. By K. C. Von Leonard, *Professor at the University of Heidelberg, in Germany. With illustrative engravings. Translated by the Rev.* J. G. Morris, *A. M., and Edited by Prof.* F. Hall, *M. D. Baltimore: Published by N. Hickman.*

We have received the first number of the above work, containing 100 pages, 12mo; and others are to issue as soon as they can be prepared for the press. The author of these lectures is well and advantageously known by his publications on Geology, and the kindred departments of science. The lectures which the translator and editor are now presenting to the American public, were delivered with the laudable intention of giving a popular view of a science of modern creation, but of the highest interest, as it has rendered familiar to the philosopher the nature and history of those successive events which, in the order of Providence, were necessary, and intended to bring the globe which we inhabit from its original chaotic state into that condition by which it was fitted to become the habitation of moral and intellectual beings. Were we to attempt to enumerate the discoveries, and the fair and necessary inductions of the Geologist, they would, to most of those who have not made the science a study, appear to be the creations of fancy, rather than the legitimate conclusions of sober judgment, under the guidance of sound philosophy. It is not only right, therefore, but is most praiseworthy, for the cultivators of this, as well as of other, departments of science, not only to enlarge its boundaries, but to diffuse a knowledge of it by presenting it to the public under an aspect the most familiar and attractive of which it is susceptible.

It appears that popular introductions to geology were almost unknown in Germany prior to this publication, although there are many such in France, England, and our own country; some of these have great merit, whilst others are from the hands of the mere manufacturers of school manuals, the productions of persons much better acquainted with the book market than with the science which they pretend to render familiar. We hail the work before us with pleasure, as the production of a philosopher of a vigorous mind, fully imbued with a knowledge of the subject matter with which his pen is occupied. It is no easy task, however, for one who has rendered himself familiar with the higher departments of any branch of science, to descend sufficiently from his elevation to conduct the inquirer in his first steps; it is in this point that such attempts, most frequently, fail, and from this objection the work before us is not entirely exempt. The published number contains three lectures; the first is devoted, principally, to the subject of mining, including its connexion with geology, and containing a general notice of mines, miners, and mining operations, illustrated by thirteen engravings on wood. We have read this lecture with much gratification; its history and its anecdotes are well calculated to induce in the reader a de-

sire to learn more upon that subject, which may be said to lie at the foundation of all our improvements in other branches of knowledge.

The second lecture is on the *Sciences auxiliary to Geology. Natural Philosophy, Chemistry, Mineralogy, General properties of bodies, with observations on Light, Heat, Electricity, Galvanism, Magnetism, and Thermo Magnetism.* The third is on *Chemical Phenomena, Elements, Oxygen, Hydrogen, Nitrogen, Carbon, Sulphur, Chlorine, Fluorine, Phosphorus, &c.* In these two last lectures more has been attempted than it was possible to accomplish in the space devoted to the subjects above enumerated; some of these are in their nature too recondite for brief explanation, and where such explanation is unsuccessfully attempted, the result is absolutely injurious; probably there are some obscurities in the translation which may not be chargeable on the original, but of this we have not the means of forming a judgment. In the definition of Natural Philosophy, p. 48, we are told that "Natural Philosophy investigates the changes which occur in inanimate bodies, and the laws which regulate those changes;" now this would answer rather better for a definition of Chemistry than of Natural Philosophy. We are told, p. 50, that "some of the *general peculiarities* of bodies are Extension, Impenetrability, Divisibility, Vis Inertia, Mobility, and Porosity." For designating those *general properties* which are common to all bodies, and without which we cannot conceive of their existence, "general *peculiarities*" is a very badly chosen term. "Porosity," although, in fact, a common property of bodies, does not appear to be essential to matter, and might have been advantageously omitted; porosity may more properly be considered as an accidental than a necessary condition of matter. In speaking of Extension as that property of a body by which it occupies space, we are told, p. 50, that "the usual expression employed to designate the space is *volume*;" now this term, most certainly, appertains to the body, and is not correctly used to designate the space occupied by it. We are informed, p. 61, that "the method of making ice, and cooling water in hot climates, depends on the principles of the conduction of heat," and then follows, by way of illustration, an account of the mode of making ice in Bengal; in which process the effect is due, exclusively and entirely, to radiation and evaporation, without the most remote connexion with *conduction.* At p. 63, it is said that "Water, when frozen to ice, loses its caloric and becomes lighter; hence ice, though a solid body, swims on the surface of water;" to the uninstructed, this paragraph would convey the idea that the ice became lighter in consequence of the loss of its caloric; and that the ice actually weighed less than the water from which it was produced, neither of which is the fact, as the intelligent author must have known. We are also informed, on the same page, that "heat necessarily escapes whilst the water is undergoing the process of freezing, and it arises in the form of vapour." This is both vague and incorrect; heat cannot assume the form of vapour, although it may convert liquids or solids into that state. There are several other inaccuracies touching the nature and action of caloric. Speaking of the electric spark, p. 68, we are informed that "it is by these sparks, which, with the imperfect apparatus originally used, could scarcely be made visible, that electricity has been rendered one of the most wonderful agents in nature." A more awkward and incorrect manner of expressing the fact that the electric fluid is such an agent, could not be well devised. In speaking of conductors of electricity, p. 69, it is said, "Thus metals, water, and other substances, receive electricity by *induction,*" meaning, we suppose, conduction; this most probably is an error of the press, but it is not noticed

in the *errata*. On other points relating to chemical phenomena, a considerable number of inaccuracies occur, which we have neither space nor disposition to point out; our main object being to show the necessity of greater care in the future numbers. There will, we apprehend, be little danger of the recurrence of such inaccuracies when the subject of Geology, the main object of the lectures, is on the tapis, and we anticipate much pleasure from the perusal of the future numbers of this work, as we have no doubt that they will tend equally to excite and to gratify a taste for this department of science.

The Editor has pointed out some inaccuracies in the original text, and has added, in the form of notes, several facts and observations which increase the value of the work.

Franklin Institute.

Sixty-first Quarterly Report of the Board of Managers.

The Board of Managers respectfully submit to the members of the Franklin Institute their report for the last quarter.

The lectures of the Institute closed on the 10th inst., having been, as usual, well attended, and having afforded high satisfaction to the large class which they drew together. The Board renew the expression of their thanks to the able lecturers on Chemistry, Natural Philosophy, and Technology, to whose efforts the success of the courses is due. They cannot but regret that it has not yet proved practicable to carry into effect the arrangements for extending the accommodations of the Institute, by which greater comfort would be secured for those who attend the lectures, and the lectures themselves be opened more widely to the public. The taste which the courses of the Institute has, in so great a degree, tended to diffuse throughout our community, for scientific lectures, goes on increasing in a rapid ratio, and the Board feel confident would, even now, more than justify a considerable extension of the present means to satisfy the demand. The schools of the institution have been as successful, in their way, as the lectures, and the Board feel pleasure in expressing their sense of the abilities and zeal of the teachers of ornamental, mechanical, and architectural drawing. The want of more extended accommodation for the schools is, also, severely felt.

The Journal of the Institute, under the editorship of Dr. Thomas P. Jones, with the assistance of Professor John Griscom, continues to merit and to receive the patronage of the members and of the public. The number of exchanges with domestic and foreign journals, particularly with the latter, and of subscriptions has been considerably increased, furnishing not only an additional opportunity for the selection of interesting matter for the Journal, but going also to increase the supplies for our library and reading room. These two departments continue favourite ones with the members, and are among the most useful of the institution. Several valuable additions have been made to the library by donation during the past quarter, and many by purchase. The deficiencies existing in some of the sets of foreign periodicals have been nearly all supplied.

The other collections of the Institute are increasing. The cabinet of minerals is now entirely arranged, and labeled, and by the aid of a catalogue marking the deficiencies in species, we shall have an opportunity of completing this already valuable collection. The cabinet of models re-

quires more room for the display of the articles, and a place of easier access than at present. The Board believe that when these conditions shall be realized, the collection will rapidly increase by donations. We want an extensive collection of raw materials and products of art, or a technological collection, in the widest sense of the term, and no institution in our country possesses more favourable opportunites of obtaining such, when we can furnish mechanics and manufacturers a suitable opportunity for the permanent display of their products.

The Committee on Premiums and Exhibitions have nearly completed the arduous task of preparing their report upon the articles submitted last autumn for examination. The care which is always exercised in the awards made by the Committee, necessarily delays their report, and on this occasion the very great number of articles brought forward, has increased the delay beyond what is usual. The Board are pleased to be able to state that the report of the Committee will very soon be in a state to submit to the members.

The Committee of Science and the Arts have pursued their usual useful labours. Inventors, though frequently disappointed in the result of the cool judgment by the practical and scientific men composing the sub-committees, have the candour sometimes to commend the good advice which they receive. Many thanks are due to these members who devote valuable time to labours, the results of which very frequently do not appear before the public, and who are thus deprived of a powerful stimulus to exertion in the appreciation by the public of their useful labours.

Since the last report, the award of two Scott's legacy premiums has been recommended, and a sub-committee is now engaged in examining such articles submitted at the last exhibition as may be returned for the purpose of competing for this premium. The Board learn that the die for the medals which are to accompany the premiums, an appropriation for which has been authorized by our City Councils, is in preparation, and hope soon to be able to submit it to the inspection of the members. By reference to the conditions of the award of these premiums, it will be seen that they are liberal, and intended to render their attainment by meritorious inventions as easy as possible.

The monthly meetings have been revived lately under the charge of a committee from the Institute, with the spirit which formerly characterized them; and the attendance has increased at once with the efforts to present attractions to the members.

The Board have still to regret the failure of the appropriation in the Legislature of our State, for establishing a School of Arts. It is truly remarkable that in a state like ours, so dependent upon mechanical industry for its prosperity, the importance of establishing a school in which the principles of science bearing upon the arts, should be taught to young mechanics, in the way, and within the time, suited to their business, should not be so generally admitted, as to secure the cordial co-operation of the Legislature. The Board continue to keep this important object steadily in view, and hope that public opinion will ultimately set so strongly in favour of the School of Arts as to be irresistible.

In conclusion, the Board congratulate the members of the Franklin Institute on the continued prosperity of the Institution.

The following named gentlemen have become life members during the

present quarter: Hector Orr, Edward Miller, Ellwood Morris, Richard C. See, and Jos. M. Truman.

The Treasurer's account is herewith submitted.

JOHN AGNEW, Chairman.

WILLIAM HAMILTON, Actuary.

April 17, 1839.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on E. Tilghman's Railway Bar.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination an improved Railway Bar, invented by Mr. Edward Tilghman, of Philadelphia, Penn., REPORT:—

That "the nature of the improvement consists in so forming the bar that there shall be a reduction of the height usually given to the ⊥ rail between its head and the base on which it rests: thereby diminishing the leverage of the rail, while its strength and capability of being firmly secured to the cross tie, are provided for by the addition of a rib directly under the centre of the base, which rib may be made plain, trapezoidal, or with a lower web.

To fasten the rail, the lower rib is inserted in the cross ties, and wedged securely to its place, where it is supported conjointly upon the ordinary base, and the under part of the lower web. A chair, or flat plate of iron, is inserted immediately under the upper base, or support, to receive which, notches are made in the ends of the bars, so that when two of them are put together, these notches form a mortise through which the chair is to be inserted. The chair is affixed to the cross ties" by spikes or screws.

The Committee having tested the strength of the improved *trapezoidal* rail, weight 48 lbs. per yard, by the rules laid down by Professor Barlow in his account of "Experiments on the transverse strength and other properties of malleable iron, with reference to its uses for railway bars," feel satisfied it will sustain a weight of from six to seven tons without injury, (the supports being 33 inches apart) or about 75 per cent. more than the most approved rail of similar weight now in use.

With reference to *leverage*, the improved rail is decidedly preferable to the ⊥ rail, the distance between the upper surface and support being considerably less, and as its entire depth is greater than that of any other rail known to the Committee, (and may be increased at a slight expense without changing the position of the main support, or increasing the leverage,) it consequently follows, as the depth governs the deflexion, that the improved rail is much the most stiff and rigid.

In point of economy, the Committee are of opinion that the improved *trapezoidal* rail will be found less expensive than the ⊥ rail. The plan suggested for connecting the bars, and attaching them to the sills, they conceive permanent and simple.

By order of the Committee.

WILLIAM HAMILTON, Actuary.

March 14, 1839.

Report on Eastwick & Harrison's Eight Wheel Locomotives.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, to whom was referred for examination Messrs. Eastwick & Harrison's Eight Wheel Locomotives, REPORT:—

That these engines possess two peculiarities of an important character; one in the arrangement of the driving wheels, and the other in the mode of maintaining the fire draft.

It is well known to engineers, that the efficiency of the locomotive engine depends, first upon the quantity of steam which the boiler may be capable of generating in a given time, and secondly on the amount of friction, or, as it is technically termed, adhesion, between the driving wheels and the road. As the adhesion increases with the weight, it is evident that the engine becomes more effective by increasing its weight, and by throwing a greater proportion of this weight on the drivers.

But a limit to this increase of weight arises from the incapacity of the road to sustain the great pressure thus thrown on a small bearing surface.

To obviate this difficulty, engines have been made with all the wheels coupled so as to constitute them all drivers, and thus distribute the *adhesive* pressure over a greater extent of the road.

Engines of this description are used for heavy and slow draught, but are considered unsafe, from their liability to be thrown off the track at curves.

Another plan, patented a few years back by an engineer of this city, was to use four drivers, and at the same time to carry the front end of the engine on a guide truck, as in the six wheeled engine. But here a new difficulty arose in consequence of the engine having three points of bearing in the line of the rails, on which its weight could not be properly distributed, unless the road was entirely free from irregularities of surface: a condition not to be found on any of the roads which have come under the notice of the Committee.

The improvement invented by Messrs. Eastwick & Harrison is designed to obviate this difficulty, by giving to the eight wheel engine only two bearing points, one on the guide truck, and the other on a frame supported by the driving wheels. The axles of the drivers are placed one in front, and the other behind, the fire box, and are confined between pedestals of the usual form fixed to the main frame of the engine, which allow vertical play, but prevent any horizontal motion.

The bearing pins, instead of abutting against springs fixed to the frame in the ordinary manner, are jointed to the extremities of horizontal beams of cast iron, one of which is placed on each side of the engine.

To the centre of these beams, or levers, are jointed wrought iron rods, which pass down through the engine frame, and carry the springs which support the weight of the engine. The connecting rod of the piston is attached to the hinder wheel, and this communicates motion to the front driver by a coupling rod attached by a ball and socket joint.

It is evident that this arrangement will allow to each driving wheel, an independent vertical motion, with the advantage that the engine will partake of only one half the vertical motion of either wheel, in consequence of being suspended at the centre of the horizontal sustaining beam.

The front drivers are without flanches, in order to avoid any difficulty in turning curves.

The peculiarity in the means of maintaining the fire draft, is an apparatus for equalizing the effect of the exhaust steam in the smoke stack, somewhat similar to Gurney's contrivance.

Instead of exhausting directly into the stack, the exhaust steam enters two copper chests, one connected with each cylinder, and escapes from these into the chimney through a number of small tubes.

With the aid of this contrivance the anthracite fire is kept in a state of intense activity, and generates an abundance of steam without the annoyance and danger arising from the smoke and sparks of a wood fire.

The heat of the anthracite fire has been found so great as to melt down the grate bars of cast iron which were used in the first experiments with this fuel.

Messrs. E. & H. have since substituted grooved wrought iron bars, which are protected from the action of the fire by a coating of clay placed within the grooves.

A trial of one of these engines on the road between Broad street and Peter's Island, was witnessed by several members of the Committee, on the 25th of April last.

It happened, unfortunately, on that occasion, that the business of the road did not furnish so many cars as were desirable for a fair experiment.

The particulars so far as made known to the Committee, were as follows:

Weight of engine, 28,350 lbs.	Weight on drivers, 18,059 lbs.
Cylinders, 12 inches diameter,	Steam, 90 lb. to square inch.
Length of stroke, 18 inches,	Driving wheels, 44 inches diameter.

The train consisted of 32 loaded cars, estimated at 5 tons each, 2 empty cars weighing 9800 lb., and tender, 5 tons, making a total of 169 tons. This train was started with great ease on a rising grade of 27 feet to the mile, and drawn to the foot of the inclined plane, the distance being about 3 miles, partly on a rising grade of 35 feet to the mile, with several short curves, and the road in such bad condition as to keep the sustaining beam in continual vibration.

A few days after this experiment, one member of the Committee had an opportunity of witnessing a more decisive trial of the power of the engine.

On the latter occasion, the train consisted of 34 single cars, estimated at 5 tons each, 4 double cars, 10 tons each; one of Mr. Dougherty's iron boats 50 tons, and the tender, 5 tons; total, 265 tons.

This train was started without difficulty, on the same rising grade of 27 feet to the mile, and drawn over the 35 foot ascending grade and short curves with apparent ease, and with steam blowing off during the whole trip.

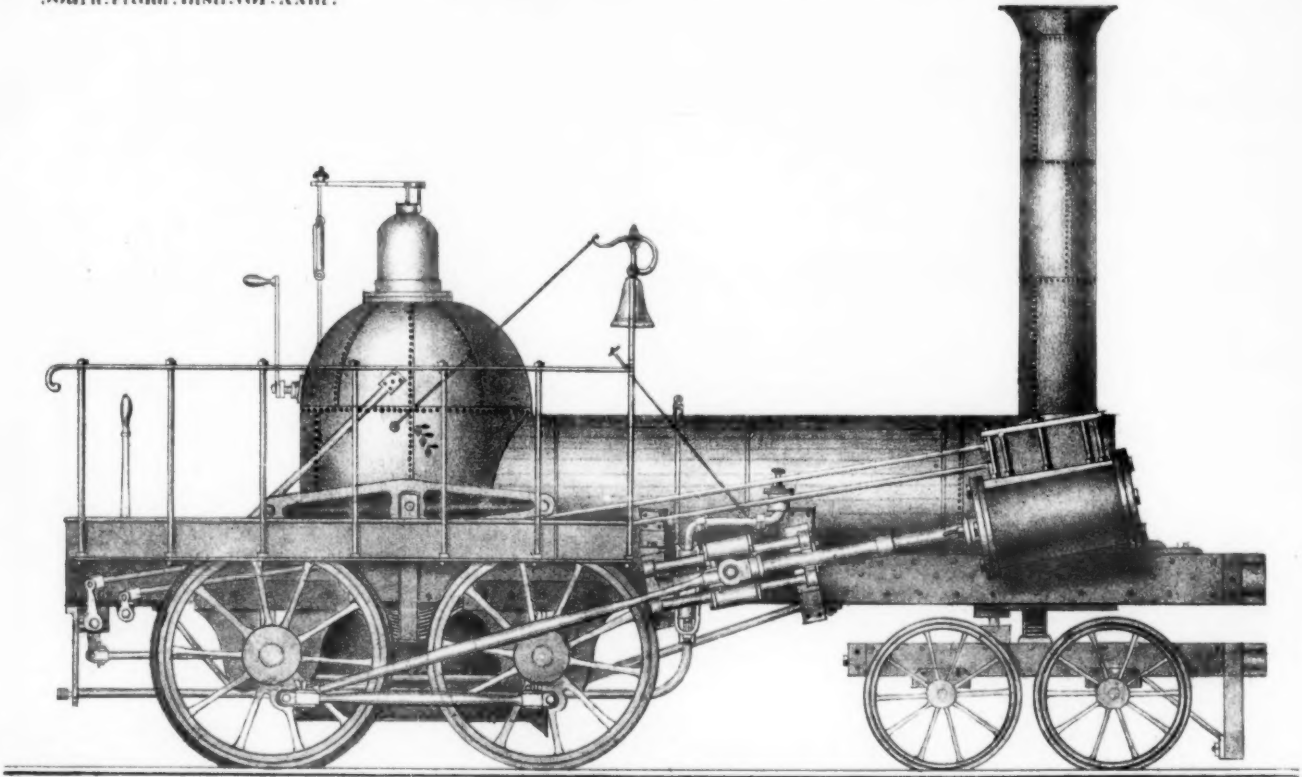
This highly interesting experiment was brought to a close somewhat abruptly after proceeding about 2 miles, by the breaking down of one of the cars near the middle of the train.

Although this accident abridged the trial of the power of the engine for draught, it afforded an opportunity of displaying another excellent trait in its performance, this was the facility of reversing* while under way.

As soon as the accident happened, a person stationed on the after part of the train passed a signal to the engineer, the latter immediately reversed the engine and brought the enormous moving mass to a stand before it had run half its own length. The satisfactory character of the experiments

*For a report on this mode of reversing, see Journal of Franklin Institute, vol. xviii., p. 179.

EASTWICK & HARRISON'S IMPROVED LOCOMOTIVE ENGINE



Harrison Jr. del. P.S. Duval Lith.r Philad.a On Stone by A. Hoff's

EASTWICK & HARRISON'S IMPROVED LOCOMOTIVE ENGINE

detailed above is sufficient to enable any one who is conversant with transportation on rail roads, to form a correct opinion of the merits of this engine. The impression of those members of the committee who witnessed the trials, is, that it is well adapted for the use of anthracite as fuel, and for very heavy draught; with less tendency to injure the road or to receive injury on a bad road than engines of the usual construction.

By order of the Committee.

WILLIAM HAMILTON, Actuary.

May 9, 1839.

At the request of Messrs. Eastwick & Harrison, the committee insert the following letter from A. Pardee, Jr. Esq., Engineer of the Beaver Meadow Rail Road, in reply to their letter requesting information relative to the construction of the road and the performance of their engines upon it.

COM. PUB.

Hazleton, Pa., June 8th, 1839.

MESSRS. EASTWICK & HARRISON,

Gentlemen—I have received your's requesting information as to the construction, &c. of the roads in this region, on which your eight wheeled locomotives are employed.

The Beaver Meadow Rail Road, where one of those engines has been in use two years, has an iron plate rail of $2\frac{1}{4}$ by $\frac{5}{8}$ inches; the wooden rails or string pieces, are oak, a portion 5×7, the remainder 5×8 inches; where the 5×7 rails are used, the cross ties are placed three feet from centre to centre, where the 5×8 they are four feet. The cross ties are laid on plank mud-sills $2\frac{1}{2}$ inches thick by 10 to 12 inches wide. The shortest curve has a radius of 300 feet; length about 200; but at the foot of the inclined planes, there is a curve, around which the engines now daily pass, the radius of which is 250 feet, the length about 300. The heaviest grade is 96 feet per mile, at two points, about $\frac{3}{4}$ mile each, there is an average grade of 80 feet per mile for 5 miles—on the heaviest grade the shortest curve is 550 feet radius, the length about 400 feet. The Hazleton Rail Road, on which two of your eight wheel engines are now in use, has a plate rail $2\frac{1}{4}$ by $\frac{5}{8}$ inches, the string pieces are yellow pine 5×9 inches, the cross ties 4 feet apart, from centre to centre, the mud-sills $2\frac{1}{2}$ by 10 to 12 inches. The heaviest grade is 140 feet per mile for $1\frac{1}{2}$ miles; this part of the road was not intended, when made, for the use of locomotive power, but it was found in practice that by doubling our trips we could use the engines with more economy than horse power. In regard to the effect on the road, so far as my experience goes, and I have seen the two classes of engines in daily use for more than two years, I would say that the eight wheel engine was easier on the road than a six wheel engine of the ordinary construction, with the same weight on the two driving wheels as on each pair of the driving wheels of the eight wheeled.

There are now in use on the Beaver Meadow and Hazleton Rail Roads, seven locomotive engines with horizontal tubular boilers, in which anthracite coal is exclusively used as a fuel after the first fire in the morning, and that we continue to use it when we can have wood for the cost of cutting, is sufficient evidence that we find it to our advantage. We have the Hercules at work, and so far, she performs well, running around the curves with great ease. Respectfully yours,

A. PARDEE, JR.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JUNE, 1838,

With Remarks and Exemplifications by the Editor.

219. For improvements in the *Net for catching Mackerel* and other fish at sea, or in deep water; Benjamin W. Hale, Newbury, Essex county, Massachusetts, June 4.

This, as the title indicates, is a patent taken for constructing a net to be used at sea. The manner of fixing the floats and attaching the lines so as to adapt this net to the designed purpose, are shown in the drawing, and explained in the specification; and the claim is necessarily founded upon, and limited to, these particular devices.

220. For an improvement in *Gas burners;* Antoine Arnoux, city of New York, June 4.

The claim under this patent is to the "increasing the length of the socket, and giving it a conical form at the top; and the placing over it a cover." The patentee remarks that "The intensity of the flame of a gas light depends upon the shape and dimensions of the flame, the disposition of the burner, and the relation of the flame to the air," and believes that he has by increasing the length of the socket, and by making the top conical, taken advantage of these principles. The particulars of form would require to be shown by a drawing.

221. For an improved mode of *Making and Stretching the Sackings of Bedsteads;* William S. Anderson, Shelbyville, Tenn., June 4.

Like many other *improvements* which are made the subject of patents, the main novelty in the foregoing consists in attaining the end proposed in a way less convenient and useful than had been previously known and practised. In the present instance, the sacking is to be in two widths, the side and foot rails of the bedstead are to be round, and the sacking is to have a wide hem at one side and end, forming a space for the side and foot rails to pass through. The two parts are to be corded up the middle. The sacking is to be strained endwise by being attached to a cross rail or stretcher, towards the head. A screw passes through the centre of the head rail, and into the cross rail or stretcher, and by turning this screw the sacking is to be tightened; the screw is represented in the drawing as made of wood, and the whole device is rather *wooden*. Rails tightened by screws passing through a head rail have in England been nearly as common as bedsteads, for at least a century past, and thousands of them have been brought to this country. The sacking did not, it is true, embrace the rails, and so far, the thing may be new, but we think the utility of this part will be confined to the bed bugs, who will find in it a "snug harbour." The claim is to "the sacking made, fastened, and stretched, substantially, as herein described, in combination with the stretcher, as herein described."

222. For a Machine for *Cutting Straw, Hay, Turnips, &c.;* Ebenezer Dewey, Butternuts, Otsego county, New York, June 4.

The claim made is to the manner of adjusting the bed knife, which is an adjustment scarcely worth describing; the patentee, however, has occupied a

large number of pages with the description of *his* straw cutter, which is one of the most common kind, consisting of a trough for containing the straw to be fed towards one end, and there cut. In the office, the mode of adjustment was of course considered as containing something new, or the patent would not have been granted.

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223. For Manufacturing a *White Pigment to be used as a substitute for white lead;* William Cumberland, city of New York, June 7. (See Specification.)

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224. For a *Machine for Shaving Shingles;* William Thorn and James Thorn, Jr., Plainfield, Essex county, New Jersey, June 7.

The shingle to be shaved is placed upon a table, and passed in between revolving, feeding rollers, which conduct it to a revolving cutting cylinder, carrying knives which extend across the shingle. The bearings of this cutter cylinder are in slides which are made to rise vertically by means of an eccentric, for the purpose of giving the proper taper to the shingle. As it leaves these cutters, the edges are dressed by knives on vertical, revolving shafts, which complete the operation.

"The invention claimed consists in the combination and arrangement of the parts for giving the horizontal cylinder of cutters a simultaneous vertical motion, as the shingle is drawn between the rollers, by which it is made to receive its proper taper, in the manner described; also the combination and arrangement of parts for jointing shingles of different widths, as described." The latter claim relates to the means of bringing one of the jointing cutters up against the side of a shingle, so as to operate upon it whatever may be its width.

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225. For a *Washing Machine;* Robert W. Olephant, North Granville, Washington county, New York, June 7.

A trough is made to contain the suds and the clothes to be washed; this trough may be three feet six inches long, and fourteen inches wide, the sides flaring out; it may be twelve inches deep at one end, and fifteen at the other, the bottom forming an inclined plane. A beater, with handles, is to be worked backward and forward in the trough, by hand; this beater rests on friction rollers on the bottom; and friction rollers may also be placed for the handles to bear on; the descent of this part also facilitates the operation. The beater being worked by hand, it is remarked, always accommodates itself to the quantity of clothes. The claim is to "the combination of the beater, moved by hand, with the respective rollers and the inclined bottom of the trough, constructed and operating as set forth.

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226. For *Forcing and Raising Water* by the aid of a triple sliding valve; Elisha Vance, Wilmington, Clinton county, Ohio, June 7.

The patentee says that his "invention consists in a triple sliding valve, which receives and discharges the fluid alternately into a box, or double cylinder;" and this he claims. It is much more easy to alter than it is to improve the valves of pumps, the best valves we mean, and we are well convinced that in the present instance no useful advance has been made; the affair is somewhat intricate, and we shall not attempt to describe it; but for the guidance of those who may be seeking improvements, we will observe that the perfection of a valve depends upon its giving, when open, an

ample passage to the water without wiredrawing it; upon its opening to a short distance only, and closing rapidly; and upon its changing the rectilenial direction of the water as little as possible.

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227. For a *Portable Saw Mill;* Pearson Crosby, Fredonia, Chatauque county, New York, June 7.

In this machine the saw used is a straight one, strained in a frame in the ordinary manner, excepting that there is a change of form in the straining apparatus. As it is proposed to use a thin saw, guides are constructed to prevent its deviation; there are also a number of friction wheels, and several devices of a peculiar character, which are intended to be embraced in the claims to "the arrangement of the stocks and rollers for keeping the saw true, in combination with the reciprocating saw-gate; and the combination and arrangement of the levers, rods, spring, screw, and dog, for feeding and regulating the feed as described."

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228. For an improvement in *Lamps;* Samuel Rust, city of New York, June 7.

Mr. Rust is the patentee of several improvements in the common house lamp. His lamps have flat wicks, which are usually raised by a toothed roller turning within the tube of the burner. The patent above named was taken for an improvement upon this plan by substituting a thin wheel toothed on its edges, for the roller; this wheel may be from three eighths of an inch to half an inch in diameter, and its toothed edges are brought into contact with the wick by cutting a slit through the burner and stopple which will admit it to enter; the wheel revolves on a pin attached to the tube, and may be turned by touching it with the finger, a pin, or other article.

We believe that this improvement, so called, has not gone into use, as we see Mr. Rust's lamp in extensive use with the original revolving cylinder, which operates so well as scarcely to leave any thing to be desired.

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229. For an improvement in the *Rake for Raking Wheat, Rye, &c.;* Daniel Smith, Vincennes, Indiana, June 7.

The rake described is said to be "For raking wheat, rye, oats, barley, peas, without cutting. Rice, buckwheat, flax, and hemp, if rotted in meadows, and many other articles, without rubbing out the grain, or rubbing off the lint or leaves." The patentee gives special directions to the carpenter how to lay off, and make the rake; and to the operator respecting the mode of using it; the description and claim do not occupy much space, the latter being to "the method of arresting the revolution of the rake, and the springs, or runners, attached to the teeth, upon which the rake slides." The rake itself, is like such horse rakes as have been long in use, which are allowed to turn over and deposit the material raked, and by this revolution to present another set of teeth to operate as before; the device claimed as new in this part is the manner of disengaging the handle by which the rake is guided and managed, and of replacing it on the opposite side. The rake is sometimes to have one row of teeth only, in which case it is tilted up to discharge its load. The springs, or runners, are merely pieces which are to run upon the ground, and raise the teeth to a small height therefrom.

230. For an improved mode of manufacturing *Flying Shears for the purpose of Shearing Woolen Cloth;* Seth Parsons, Hoosack Falls, Rensalaer county, New York, June 7.

The tool, or instrument, which forms the subject of this patent, is for bending the plate of steel, or rather of iron laid with steel, which is to stand spirally round a shaft, in such manner as that it may be perfectly, and almost instantaneously, formed, when heated. The blade is not only to be bent into the spiral form, but it is also to be bent at right angles longitudinally, so as to form a flanch by which it can be screwed to the cylinder, and be removed with perfect facility. A shaft is formed of the same diameter with that to which the blades are to be attached, and this is surrounded by a spiral wing, having the curvature to be given to the shear plates. The plate is to be first bent at right angles longitudinally, it is then heated, and applied against the spiral wing, where it is held by a suitable device; this part of the instrument is on a carriage running on ways, and by drawing it forward, rollers properly formed and placed, bear against the plate, and give it the right set. The claim is to the manner of constructing the machine so that by "the combined action of the rollers and winged shaft, in the way described, the flying shear receives the exact form and set necessary to its being affixed to the shaft."

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231. For an improved *Variety Couch;* Eleazer Carver, Bridgewater, Massachusetts, June 12.

The claim to this couch would not afford any idea of the particular manner of forming it, nor would an examination of the thing itself present much of novelty to any one acquainted with the numerous articles of the kind which have been contrived. Said couch, or easy chair, may be suspended, so that its occupant may be swung within it; the inclination of the back, and other parts, may be varied, by means of notched segments, bolts, thumb screws, &c. &c. The patentee is limited to his own particular arrangement, and it would be a folly to attempt to violate his rights.

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232. For an improved *Windlass;* Frederick G. Cameron, city of New York, June 12.

The gearing of windlasses has undergone numerous modifications for the purpose of increasing, or regulating, the power according to the resistance to be overcome; and every machinist knows that this may be accomplished by modes capable of indefinite variations. There is no difficulty in the thing, but much merit in devising new modes which shall excel those in use, in simplicity, stability, or convenience. We cannot describe the manner of carrying the thing out in the case before us, but it appears to be good, and may probably be found to possess the desired qualities.

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233. For an improvement in the manner of *Forming the Ribs of Saw Gins,* for ginning cotton; Eleazer Carver, Bridgewater, Plymouth county, Massachusetts, June 12.

The claims under this patent will afford a tolerably clear idea of the nature of the improvement; they are to the giving of a ridge form to the upper surfaces of the ribs, to give an inclination of the seeds towards the saws, and prevent the breaking of the fibre by the obtuseness of the angle against which they are forced; to the giving a larger space for the filling the saw teeth with cotton; to a slope given to the ribs where the cotton is drawn in,

thereby increasing it in width, and allowing the seeds to escape, to prevent it from being choked.

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234. For a *Machine for Shelling Corn;* Thomas Wright, New Village, Warren county, New Jersey, June 12.

This corn sheller operates like the common bark mill with a conical nut turning within a shell, or case, the axis of the nut being vertical. The nut is set with pins for shelling the corn; and the case within which it turns is formed of staves, or slats, denominated springs, as they are made thin enough to be elastic; these are connected together by a ring at their upper ends, but having play at their lower ends; they are surrounded by a hoop, furnished with check screws, to regulate the distance to which they may spring; there are spaces between the staves sufficiently wide to admit the passage of a grain of corn. The claim is "to the construction and arrangement of the springs forming the concave around the frustrum of a cone, in combination, as above described, with the large ring and screws for confining them in a circle, and at the same time allowing the lower, or larger, ends of them to recede from the centre when large ears of corn are admitted, and to advance towards it again when small ears are admitted."

The corn is to be put into a feeding hopper of the usual form, but we do not find any thing to cause it to enter the machine endwise, without which the cob must necessarily be much broken up.

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235. For a *Planing Machine;* Robert Luscombe, Benton, Yates county, New York, June 12.

This machine has its irons for planing fixed at the ends of the arms of a wheel revolving horizontally, below which the stuff to be planed is made to advance as in some other machines. There is, in fact, a number of the same class, and the patentee has confined his claim to "the application of springs to the face of the planing wheel, in the manner substantially as described." These springs are to bear upon the stuff, and the patentee states their use to be "first, to steady the motion and prevent any vibration of the wheel while in operation; and secondly, to give the face of the springs, or planing wheel, a constant bearing on the stuff being planed, and keep it on a level with the cutting edge of the plane irons, as the irons wear away by use."

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236. For *Bedstead Fastenings;* Pardon Post, New Haven, Connecticut, June 12.

These fastenings differ somewhat in form from some that have been long used, or rather which were used many years ago, for the same purpose, but they are the same in their mode of action. A cast iron plate is to be fastened on the ends of the rails, these plates having dove-tailed, or wedge-formed, projections on them, which fall into recesses in corresponding plates screwed to the posts. The claim is to "the addition of a plate having two dove-tailed tenons fitting into the lower part of another plate; the whole being constructed substantially as described."

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237. For improvements in the *Flyer for Spinning Cotton, &c.;* Richard E. Yerkes, city of Philadelphia, June 12.

The difference between this apparatus and some before in use is not of

that striking character as to be pointed out without the drawings and references; the claim, therefore, if given, would not afford this information.

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238. For an improved *Sliding Sofa Bedstead;* George Wode, city of New York, June 12.

Pieces of furniture of this description have been modified in a hundred forms, and were their history written, its readers would be few in number; in the case before us, the patentee claims "the combination of a hinged front with a hinged frame; a windlass and endless screw for tightening the sacking bottom with the sliding rails," and various other matters and things, that to be understood, must be seen. The thing is neat and commodious.

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239. For an improvement in the *Door Lock;* Turner Whitehouse, Boston, Massachusetts, June 14.

There is not much of novelty in this lock, and the claim is in consequence principally confined to some unimportant peculiarities; it is to the application of spiral springs acting on the dog and arm in returning the latch bolt to their original positions; and to the post for securing the lock works in their respective places; and also to the arm as combined with the spiral spring, latch, and lock bolt."

Various friction rollers are to be used to cause the lock to work easily; the key is to turn against friction rollers on the bolt, and on the tumbler, which we are very apprehensive will prove to be troublesome appendages when the oil hardens, and the lock becomes foul.

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240. For an improvement in constructing the *Flues of open Fireplaces;* Thomas Whitson, city of New York, June 14.

This fire place is constructed with a frieze supported by two columns; the frieze is hollow and divided into two parts by a longitudinal partition; the columns also have a partition within them, dividing them into two flues, an ascending and descending. The patentee says that the nature of his improvement consists in carrying the smoke from the grate into the front part of the frieze, down the front part of the columns, and up the back part of the same to the rear of the frieze, and thence into the chimney. The claim is to "the partition above described, of the top, or frieze, and of the columns."

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241. For a *Progressive Pile Driving and Grading Machine;* Smith Cram, city of New York, June 14.

This apparatus is intended for driving piles for the foundation of railroads, in passing over valleys, or in other situations requiring a provision of this kind. The pile machine is like those ordinarily used, but it is placed upon a carriage, which is to advance as the work progresses. The piles are to be sawed off at any required grade by means of a circular saw, duly regulated. The claim is to "the combination of the power of driving the two rows of piles, with that of the grading saw; together with the scarfed shifting rails and cross ties by which the machine can be moved forward on the foundation, placed, and graded, in the prosecution of its purpose," &c. &c. We do not think it necessary to give the whole claim, as the foregoing will afford a good general idea of the construction and operation of the machine, and more than this would require drawings.

242. For an improvement in the mode of *Constructing and using Writing Desks;* Seth Luther, Boston, Massachusetts, June 19.

Claim. "What I claim as my invention, and desire to secure by letters patent, is the making the desk slide up and down on the stand, and the mode of working it up and down, in combination, as herein described; I also claim the herein described mode of changing the position of the leaves of the desk."

The foregoing points out the principal object of this patent, namely, the raising or lowering of the body of a desk upon its legs, or stand, which is to be effected by a rack and pinion, the latter being turned by a winch. The description given is very elaborate, although the thing is in itself of no very intricate nature. The "changing the position of the leaves" refers to the mode of altering their slope, or of causing them to stand horizontally. In the devices employed there is not any thing of novelty, they being such as are well known to every machinist, and the same ends might be attained by other modes, and not interfering with those claimed.

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243. For *Locks for the Doors of Banks, Vaults, &c.*; James McClory, city of New York, June 19.

This is a combination lock, the construction of which is not to be explained in words; it manifests much skill in its arrangements, and it has the merit of not depending upon the particular key fitted to it, as, should this be lost, another can be made without the necessity of interfering with the lock.

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244. For *Spiral Springs* for, and the mode of applying them to, Carriages; Remember Baker, Elba, Genessee county, New York, June 19.

These springs are to be made of a flat strip of steel, which is to be wound so as to form a conical spiral; a correct idea of this form would be given by taking a common watch spring, and drawing up its centre coil, until three fourths of the width of each coil was raised above the next outer coil. The force is to be exerted upon this spring by pressing upon its centre, so as to depress the coils and cause them to enter further one within the other.

These springs may be placed directly under a carriage, or wagon, body, one at each corner, and resting upon, or fastening the same to, the bolsters, by means of bolts.

It is proposed to attach the springs to carriages through the intervention of vibrating levers; and a claim is made to "the invention of the spiral conical spring made of flat plates of steel, and the manner of using the same by means of levers, as described."

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245. For a machine for *Sawing and Jointing Staves;* Nathaniel Moore, Ellsworth, Hancock county, Maine, June 19.

Patents have been obtained for sawing staves by means of a concavo-convex, or, as the workmen denominate it, a dishing, saw; but to this no valid claim can be made, as a premium was awarded by the Society of Arts in England for a saw of this description, as long ago as the year 1805. The staves are to be sawed by a saw of this description in the machine which is the subject of this patent, and the improvements claimed are to devices connected with the manner of moving the carriage, of throwing it in and out of gear, of setting the stuff, and of jointing the staves after they have

been sawed; these devices are exhibited by the aid of a number of figures in the drawings; the jointing is to be effected by revolving knives, placed around a vertical cylinder; several staves, after being sawed, are to be placed upon each other upon a suitable carriage, and being brought up against the cutters, are jointed at one operation.

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246. For a *Wrest Pin for Piano Fortes;* Daniel Walker, city of New York, June 19.

Instead of the wrest, or turning, pin, generally used in piano fortes, a screw is to be used to move a nut which has the string attached to it. In the block which receives the turning pins, standards are to be inserted which rise vertically from the block to the height of about two inches. A screw with a square head is to pass through a projecting piece on the upper end of the standard, its point resting on a metallic stop. This screw passes through a sliding nut, one edge of which is guided up and down by a groove in the standard, and to this nut the wire is attached. At the lower end of this standard there is a small pulley, around the lower side of which the wire passes, extending from it along the instrument. The claim is to "the application of the nut, screw, and pulley, as above described, as a substitute for the ordinary turning pin."

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247. For an improvement in the *Plough Clevis;* Aaron Carman, Columbus, New Jersey, June 20.

This clevis may probably have its merits, but we cannot make them known without devoting more space to the matter than we can conveniently afford; we should not aid in the understanding of its construction were we to insert the claims.

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248. For a *Cooking Stove*; S. J. & J. S. Gold, city of New York, June 20.

This stove the patentees denominate the "perfect coal cooking stove," but perfect as they esteem it, there can be no doubt that it will be followed by others which will be pluperfect. After describing the stove at great length, the manner of its operation is thus stated:

"Keeping the ash pit close in front, the draught of the stove causes the air first to enter the hot chamber through the open work of the door; it then passes the sides of the furnace and the air heaters, next it passes each side of the prism, and under the oven plate, into the oven; then reaching the back of the oven in the circular part, it enters through the sink in the inclined plate to the ash pit, and is ready to enter the fire through the grate, having passed this circuit instead of entering directly to the fire by the front of the ash pit in the ordinary way."

What is called "the hot chamber," is a space surrounding the iron cylinder which contains the fuel.

"What we claim as our invention is, first, the mode of heating the oven by hot air. Many have heated their ovens by hot air, more or less, but none have ever applied the hot air on the principle above described, to wit: first to the oven and then to the support of combustion. Secondly, we claim the air heaters upon the principle described. Thirdly, we claim the grate upon the principle described, when the bars are circular laterally."

By the bars being "circular laterally," is meant the giving a lateral

curvature to the grate bars, to take off the strain, and tendency to break, from their expansion by heat.

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249. For a *Spark Catcher*; T. L. Smith & W. J. Van Lone, Newark, New Jersey, June 20.

In this, as in most of the spark arresters, there will be a very considerable obstruction to the draught, which is a fatal objection. When the heated air and sparks arrive at the upper end of the chimney, they are to be turned downwards by a curved cap, with a view to the causing of the sparks to fall, by their own gravity, into a compartment prepared for them; the mode of carrying this intention into effect differs in this apparatus from that followed in others, but not to an extent, or in a manner, which appears to us likely to render it efficient.

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250. For a *Machine for Thrashing Clover Seed;* William B. Davis, Reading, Perry county, Ohio, June 20.

A revolving rubber, set with teeth, and made in the form of a frustrum of a cone, is placed within a corresponding concave, also set with teeth. The axis of this conical body stands horizontally, and the clover is fed through a hopper at the top of the huller.

The claim is to "the so arranging of the teeth on the frustrum of a cone, or runner, as to cause the chaff and seed to be discharged at the base of the frustrum, by which the heads of clover are retained a longer time in the machine, subject to the action of the teeth; all constructed and arranged substantially as set forth."

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251. For an improvement in the mode of *Constructing and Managing Vats for Tanning Leather*; Wm. & J. C. Rouse, & S. Taylor, Bedford county, Virginia, June 20.

The system of vats which form the subject of this patent are to operate upon a principle which has been before essayed and approved; that of establishing a communication through the system by means of hollow trunks, allowing the ooze to be transferred from one vat to another. The variation in the manner of carrying out this principle adopted by the patentees, has been deemed sufficiently original to be made the foundation of a patent. The bark is to be contained in a movable reservoir, or box, perforated to admit the fluid, and capable of being raised by a windlass and transferred from one vat to another.

The claims are to "the manner of arranging the aqueduct, or tubes, at or near the lower parts of the vats, in combination with those at a greater elevation, but in no case approaching the upper portion of the vats, so that the ooze may be transferred from one to the other, substantially in the manner set forth. Also the manner of connecting the lay-away vats with the first series, as set forth, so that the strong liquor may, at pleasure, be conveyed into them, in the manner set forth. We likewise claim the movable reservoir, or vat, for containing the bark."

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253. For an improvement in the *Spring Window Fastener*, for window sashes; Jonathan Bacon, Bedford, Middlesex county, Massachusetts, June 20.

This is a contrivance differing so little from other such fastenings, as not to merit any particular description. It is merely a spring latch which is to

catch into the side of the sash frame, and hold it there; it is as good, undoubtedly, as many of its predecessors, but no better. A question is often put, why does the office grant patents for things so trifling? The reply to this is, that the office is governed almost entirely by the fact of there being *some* novelty in the thing proposed to be patented; applicants are urgent, and have always, in idea, a great fortune depending upon the seal of the patent office; and if the hand cannot be placed upon something identical with the thing sought to be patented, it becomes necessary to grant it; were this not done, two or three individual applicants would consume the whole time of the office with their special pleadings on behalf of their bantlings. There is a *necessity* in such cases, of which no one, out of the office, can form a correct estimate.

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253. For a *Machine for cutting Screws on the ends of Bedstead Rails*; Jacob Lindley, Cynthiana, Harrison county, Kentucky, June 20.

The object of this machine is to cut screws on the ends of bedstead rails, and in the posts, in such manner as that a right and left handed screw at the opposite ends of a rail should enter and come to a shoulder at the same time, and in the proper place. There are but few wood turners and bedstead makers who would find any difficulty in constructing such a machine without inquiring into how the thing had been done before; and there are many who would think the labour misspent in the production of an instrument for the purpose, deeming the proposed mode of fastening bedsteads together very inferior to most others, and having, therefore, little or nothing to recommend it. The claim made by the patentee is to the particular manner in which he has arranged his apparatus.

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254. For a *Fire and Water Proof Travelling Trunk*; Charles F. Miller, Lancaster, Pennsylvania, June 20.

The claim will show the general construction of this trunk, this being to "the manufacturing of chests and trunks of double bodies of sheet iron, and filling the space between these two, with the within named composition, or with any other possessing analogous properties, in the manner described."

"The within named composition" consi sts of "equal quantitiesof pulverized chalk, and curd of thick milk, bones of animals burned and pulverized, then boiled in urine until the quantity is lessened one-third. The best kind of asbestos pulverized. Let the proportions be about one-sixth of the first, two sixths of the next, and three of the third; to these add whites of eggs and blood sufficient to make it into a paste of a proper consistence, and apply it as directed."

To animadvert on the nature and merits of this composition, would be an entire sacrifice of time; a thousand others, equally good, could be produced, and we much doubt whether the doctor takes his own medicine. The idea of rendering a *travelling trunk fire proof*, by interposing a bad conductor of heat between thin plates of sheet iron, is altogether absurd; the difficulty of making fire proof chests is well known, and those made would not suit many travellers. Any trunk may be made more perfectly *water proof* by lining it with sheet tin, soldered at the joints, than can be done by the plan proposed.

We have been informed that the patentee has sold many of his trunks, which is well enough for him; and for the good of the purchasers, we most

truly hope that they may never be put to the ordeal by fire, as they will stand but little chance of escaping unscathed.

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255. For *Preventing Canker Worms, &c. from ascending Trees*; Jonathan Dennis, jr., Portsmouth, Newport county, Rhode Island, June 20.

"What I claim as my invention, and desire to secure by letters patent, is a circular metallic trough and roof, made of one piece of metal, and bent to conform to the shape of the tree; using for the purpose any metal that can be bent into the proper shape." Such is the claim; and the trough and its roof, it is stated, may be made to stand about an inch from the tree, this space being filled by caulking with waste cotton, or other suitable material. The trough is to contain some fluid destructive of the worms, and the roof to prevent articles from falling into the trough. The apparatus is to be supported by nails or plugs driven into the tree.

We are not told how the metallic trough is to be joined so as to form a continuous circle around the tree, and although this may be effected without instructions from the patentee, it will never, or rarely, be done, excepting he can prescribe an easy mode of doing it; and we will undertake to prophecy that should he even do this, the trees furnished with his protectors will still be few and far between.

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256. For *Preserving Vegetable Substances from Decay*; John Howard Kyan, Great Britain, June 23.

This patent is for the well known process denominated the Kyanizing process, and applied principally to the preservation of timber. It consists in soaking the material to be preserved in a solution of corrosive sublimate in water, a pound of the salt to five gallons of water. The protective effect of this process has been established by the experience of several years, it having been the subject of a patent in England long prior to the issuing a patent here, which was done by special act of Congress. That body, we suppose, had sufficient reasons for granting this patent, but we have never heard, and have been unable to divine, what those reasons were. The process was well known here, and we had nothing to learn respecting it; every man in the United States had a right to use it, and this right had existed for several years, but it is now abrogated, and, it seems to us, without any equivalent. Let any American apply to the Parliament of Great Britain for an act in his favour under like circumstances, and we are well assured that he would apply in vain. National comity, therefore, did not call for the act; but we must be suffering under obtuseness of mental vision, for we may not doubt the wisdom of Congress. This act opens the door for special legislation, and there are hundreds in Great Britain who may, with equal propriety, we think, knock at the same door.

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257. For a *Machine for Filing Hand Saws*; James S. Harris, Poultney, Rutland county, Vermont, June 23.

The saw is to be embraced in a clamp, and above this there is to be a square frame to which the file is to be affixed by suitable screws, or other contrivances, attaching it to the two ends of the frame, in the proper position. This frame is to be placed across the clamp containing the saw, the frame running upon shifting ways, corresponding with the angle to which the teeth are to be filed. The details we do not think it worth while to

give, and of the machine itself we are not disposed to speak with much favour; no good workman will use it, and it will be but a poor crutch for a lame one. For this opinion we could furnish many substantial reasons, but they will occur to others capable of judging on such a subject.

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258. For an improved *Horse Power*, for driving machinery; Miles T. Mix, Danby, Tompkins county, New York, June 23.

In this horse power, the animal is to draw round, by means of a lever, or sweep, there being a centre wheel with teeth on the inner rim, which gear into four pinions, in a manner analogous to that adopted in several other machines. The particular variations, and additions, devised and adopted by the present patentee, cannot be clearly described in words; we therefore pass it over with this brief notice.

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259. For an improvement in the *Smith's Forge*; Amos Binney, Point Pleasant, Bucks county, Pennsylvania, June 23.

A cast iron box is to be built into the hearth of the forge. The upper side of the box is to be a few inches below the surface of the hearth, and is to be covered by grate bars. The bottom of the box is made to slide, and it can therefore be withdrawn; through one side of this box there is a hole for the introduction of the wind from the bellows. The coal is, of course, to stand upon the grate, and the forge is, in general, to be used in the ordinary way; but when it is desired to keep up a glowing fire without the blast from the bellows, the sliding bottom is withdrawn, and a natural draught of air admitted to the fire; a hood of sheet iron is then placed above the coals, to increase the draught.

The patentee says: "I do not claim the constructing of a cast iron or other box covered by a grate, and receiving the blast through an opening below said grate, this having been before used." He then claims the combining of the sliding bottom with such a box and grate, for keeping up a continuous fire, with the aid of the hood, as described.

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260. For an improvement in the *Hearth of Blast Furnaces*; George Poe, Elkridge Landing, Anne Arundel county, Maryland, June 23.

"The nature and object of my invention consists in conveying the melted iron into a reservoir placed on the outside of the furnace hearth, by means of a channel cut entirely out of the bottom stone, the object of which is to leave the iron in such a situation as to be accessible at all times for casting without interfering with the operation of the furnace. This channel may be differently formed, and the reservoirs be differently situated about the furnace hearth, as may best suit the purposes for which the invention is intended."

After the foregoing, the patentee describes and represents the particular manner of procedure which he has adopted, and claims the invention, generally, as above described.

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261. For improvements in the "*Furnace for Refining Iron*;" James Sharp, Liverpool, York county, Pennsylvania, June 23.

The claim will convey a good general idea of the nature of this invention; it is as follows: "I claim the constructing of the arch near the throat of the chimney to receive the pig iron for a bloom, to be heated by the escape heat

whilst the bloom is being melted in the chamber of combustion, as described."

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262. For improvements in *Stoves and Fire-places*; Joseph Hard, Stoneham, Middlesex county, Massachusetts, June 23.

"The general features of my improvement consist in such an arrangement of the oven, boiling apparatus, fire-place, and flues, that the operations of boiling, baking, and steaming, may be carried on at one and the same time by the same fire, or separately whenever occasion may require." The mode of effecting this is then described, and the following claims made:

"The combination of the tubular oven with the boiling and steaming apparatus, and fire-place, arranged and acting together as described; and separately, an oven constructed with tubular flues, passing through the same from bottom to top, and so situated that the smoke and heated air from the furnace shall pass through the same on both sides, and impart heat to the interior of the oven."

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263. For a *Machine for Cutting Straw and other Fodder*; Samuel Gibson, Arcadia, Wayne county, New York, June 27.

It will be seen by the claim that there is but little of novelty in the so-called improvement; and it may, indeed, be fairly doubted whether there is any of this ingredient, as hundreds of persons may have thought and acted upon the introduction of an additional wheel in the gearing, without sending their thoughts to the patent office. The claim is to the applying the intermediate gear wheel on a movable stand, so as to admit different sized pinions for driving the feed rollers, and thereby changing the feed, in combination with the feed rollers, and the rotary cutters."

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264. For an improvement in the *Self Acting Mule*, for spinning cotton and other fibrous substances; James Smith, Great Britain, June 30.

This patent was granted under a special act of Congress, the machine having been patented in England in August, 1834. The specification, with a plate, was published in Newton's Journal, vol. v. p. 193, Conjoined Series. Various attempts had been made to construct such a machine in the United States, from the published description, but without success; and such was deemed the value of the invention that it was found impossible to procure a machine, the inventor and the manufacturers being interested in preventing it. A purchase of the right for the United States was, however, effected by the Mattawan Company of New York, and under these circumstances the special act was granted, and that, as it appears to us, with very good reason. The machines are now manufactured by the above company, and are going into extensive use. For a description, we refer to the work above named.

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265. For an improved mode of *Changing the Poles of Electro-Magnets*; Nelson Walkley, Tuscaloosa, Alabama, June 27.

It has now become almost certain that the attempts to obtain motion with power sufficient to render it available in the driving of machinery, by electro-magnetism, cannot be successful, from causes inherent in the principle whose aid is invoked; and that if it is ever obtained, it must be the result of discoveries which will lead the experimenter into a new channel. We

shall not, therefore, undertake to describe the particular mode adopted by the patentee in the construction of his pole changer.

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266. For an improvement in the *Machine for ascertaining the weight of cargoes contained in Canal and other Boats;* Amory Awsden, Rochester, Monroe county, New York, June 7.

The claim is to "the construction of the tube, or stem, receiving the water through the small aperture at the bottom, and gradually enlarging until it connects with the cylinder, thereby preventing a sudden rise or fall of water within, and protecting the gauge from being disturbed by any sudden motion of the boat, or vessel, or agitation of water without, which is highly important when determining the weight of the cargo, and also in requiring so small a hole through the bottom of the vessel as to produce no injury whatever."

The whole device consists in a float like the bulb of an hydrometer, having a stem which operates as a gauge, or index, the water being admitted through a small opening into the tube within which the float operates.

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267. For a mortise latch for doors; Leonard Foster, Boston, Massachusetts, June 27.

A main object in the construction of this latch is to keep it flush with the edge of the door, in which a notch is made for the admission of the catch, which is driven into the door frame in the direction of the plane of the door when closed. The claim is to the "manner described of inserting a latch, consisting of a simple plate of metal, in a mortise made in the rail of the door; said latch being flush at its fore end with the said rail, and being received by a catch driven into the door frame in the direction of the plane of the door when closed. I also claim the attaching of a small lock to the latch in the manner and for the purpose described." The lock alluded to is to shoot out a small bolt which is to pass under the catch of the latch, which, as the lock is attached to said latch, will effectually prevent its being lifted.

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268. For an improved *Press;* George C. Chesley, Rocky Mount, Franklin county, Virginia, June 27.

The patentee says that his press is "to operate by a combination of lever power in the common lever in length and strength, and the power of the screw and wedge," in which announcement there appears to be some obfuscation. As represented in the drawing, a lever placed horizontally, is to be drawn down by means of a windlass, turned by a winch; this lever, and others to which it is attached, are to produce pressure upon any kind of article requiring it; their particular arrangement we shall not stop to describe, because it would take more time than we can now spare, and it would be spent upon an object which does not appear to possess any special claims on the score of its own merits.

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269. For *Stoves and Grates for burning Coal;* Eli C. Robinson, Troy, New York, June 30.

The claim is to "the manner of constructing the grate in combination with the apparatus for agitating and emptying it. And the particular manner of heating the passage for the draughts in each end of the top plate

directly over the diving flues, in combination with the flues operating as described."

The grate is divided into three parts, each of which is hung upon gudgeons, which gudgeons pass through the stove plate, and are geared together by three toothed wheels, one of which being vibrated by a handle, the whole will be agitated; and they may by the same means be emptied simultaneously.

There are up and down flues on each side of the fire chamber, with a view to the diffusion of heat.

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270. For an improvement in the art of *Increasing the strength of wrought iron and steel;* Walter R. Johnson, city of Philadelphia, June 30.

(See Specification.)

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271. For an improved *Cooking Stove for Summer;* Anson Atwood, city of Troy, New York, June 30.

A small furnace is made to contain the fuel, over which a kettle may be placed; the furnace may be cylindrical, and is surrounded by a heated air chamber, which communicates with the oven; in its rear is a square oven, through the middle of which a flue leads from the furnace, which flue is in the shape of a hollow shelf, an inch or two narrower than the oven; at its rear end this flue turns up vertically; the body of the oven may be of sheet tin, to prevent radiation. The claim is to "the manner of carrying the flattened flue through the oven, as above described, in combination with the further provision for supplying heat to the oven by the mode of connecting the space surrounding the furnace with the oven, as set forth."

We have a stove of this description; it however has not been fully essayed, not having been received at the proper season, but our full impression is that we shall report favourably of its doings.

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272. For an improvement in *Stoves;* Phineas Gillet, New Hartford, Connecticut, June 30.

The claim is to "the manner of constructing the movable oven, and of managing and heating it, for the purpose of baking or cooking, in a cavity extending from the top to the bottom of the stove." This movable oven is like a large boiler, and it is received in the same manner in a cavity at the back of the furnace, where ovens are ordinarily situated; the draught of heated air from the fire passes around and under it in its way to the escape pipe.

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273. For an improved *Cooking Stove;* Jefferson Cross, Eaton, Madison county, New York, June 30.

This stove has what is known under the name of an elevated oven, which stands at the height of fourteen inches, or more, above the stove. It consists of a double horizontal cylinder, into the space between which flues lead from the furnace of the stove. A pipe leads also from the upper part of this oven into the escape pipe of the stove. The following is the claim.

"The having means to alternately shift the heat from and to the oven, as occasion may require, which is done by adding and extending the flue so far back of the oven as to have sufficient room for the principal pipe without interfering with the oven; and by adding valves, or dampers, under

each of the columns, and under the principal pipe, or at any other given points, which will answer the same purpose, as above described."

274. For an improvement in the *Cheese Press;* Luke Hale, Hollis, Hillsborough county, New Hampshire, June 30.

A press has been in use in the eastern states, which is known under the name of the "Quaker Press," for pressing cheese, in which the weight of the cheese itself produces the required effect, through the intervention of combined levers. The press, which is the subject of the present patent, is a modification of the Quaker press, which would require a plate to make it clearly known.

275. For an improved mode of *Heating the blast in Furnaces;* Charles C. Alger, Stockbridge, Berkshire county, Massachusetts, June 30.

There are now in the hands of the engraver, cuts to accompany the specification of this apparatus; and we have also in possession authentic statements of the very satisfactory results produced by it, which we shall also publish at an early day.

276. For *Dumb Stoves for Parlours;* John G. Treadwell, city of Albany, New York, June 30.

In this dumb stove there is what is denominated a heat compartment, so constructed that when there is not fire in the stove below it, or when an increased heat is desired, a fire may be made in this heat compartment, and the heat consequently increased in any desired degree. The claim is to the manner in which the constituent parts of this apparatus are combined and connected together. The danger to be apprehended is that the two parts in question cannot be so combined as to prevent the occasional escape of smoke; should this not be the case, the advantage of the arrangement must be obvious.

277. For an improvement in the mode of *Constructing Castors, and applying them to Bedsteads;* Philos E. Blake, and John A. Blake, New Haven, Connecticut, June 30.

The wheel of the castor is inserted between two cheeks, at the lower end of a revolving axis, in the usual way, but the axis is of greater length and thickness than usual, being about four inches and a half long, and from half an inch to three eighths in diameter. A hole is bored in the axis of the post to admit this shaft, and into this hole is driven a cylindrical piece of metal; into a conical cavity on the lower end of this, the upper end of the axis enters; the lower end of the axis is embraced by a collar, likewise driven into the wood, and this completes the apparatus, which it will at once be seen is of the most simple and permanent character.

The claims need not be given, as they are intended to embrace the foregoing construction. They will, undoubtedly, sustain the patent, although they are so worded as to appear more like a claim to results than to means.

278. For an improvement in the mode of *raising and lowering the grates of Stoves;* Josiah Dutcher, city of New York, June 30.

Grates have been raised and lowered by racks or pinions, and by other means; the claim made in the case before us is to the raising them by means

of two cams placed on a revolving shaft below the grate; which cams are in form one quarter of an ellipsis, or oval.

Specifications of American Patents.

Specification of a patent for manufacturing a White Pigment to be used as a substitute for White Lead in Painting. Granted to William Cumberland, *city of New York, June 7,* 1838.

To all whom it may concern: Be it known, that I, William Cumberland, of the city of New York, in the state of New York, have invented a new and improved process for manufacturing a white pigment, with a basis of lead, to be used as a substitute for white lead, for painting, when ground in oil, or in any other fluid, according to the nature of the work to be performed. And I do hereby declare that the following is a full and exact description thereof:—

The first operation in preparing my white pigment is to obtain a protoxide of lead by triturating metallic lead in water, to which I in general add a portion of caustic soda, to facilitate the process. This production of a protoxide of lead by trituration is now practised in some manufactories of carbonate of lead, and is not of my invention, but the means which I have adopted of effecting it facilitates the process, and is as follows: I granulate the lead by fusing it, and pouring it into water, in the ordinary way. This lead I put into a triturating vessel, differing in construction from the cylinders usually employed. This vessel is somewhat in the form of a saucer, or bowl, so as to expose a considerable surface to the action of the atmosphere; it may be of cast iron, and of such size as shall adapt it to the quantity of work to be performed. An iron shaft passes through the axis of this vessel and is attached to it so that they may revolve together. The shaft is inclined twenty-five degrees, more or less, from the perpendicular, and motion is communicated to it in any convenient manner.

Into the vessel so constructed I put my granulated lead, with as much water as may be requisite, adding about an ounce of caustic soda to every four gallons of water. The revolution of the axis, combined with its inclination and that of the triturating vessel, causes the granulated lead to roll over, and thus produces the necessary friction among its particles, and also the requisite exposure to the influence of the atmosphere, in the most advantageous way. This operation is usually kept up for about twelve hours, when the oxide of lead which has been formed, and which is of a pale yellow colour, is separated from the metallic lead, and well washed. During the process, portions of water are added to supply any loss by evaporation or otherwise.

The accompanying drawing represents a machine which I have invented for this purpose. The frame work may be differently constructed, all that is necessary being so to form it that the shaft on which the triturating vessel is fixed, and with which it revolves, may be placed at an inclination from the perpendicular of from 25 to 45°, more or less. Fig. 1 represents a vertical section of the triturating vessel, and its shaft, F, F, is the body of the vessel, which has a rim, G, at its upper part, sloping inwards, to retain the water and lead; the inclination of this part being proportioned to that given to the axis. I, is a hub of lead, surrounding the shaft, E, E, to prevent the lead from coming into contact with it. J, J, is an iron bed, or cup, which

serves as a seat for the triturating vessel, supporting it, particularly when made entirely of lead. In fig. 2, A, A, are two upright posts supporting the cross timber, B, which sustains the upper end of the shaft E, E; there being at its lower end a sill timber, c, and stop, D. A cog or band wheel, H, may occupy any situation on the shaft, which may be found most convenient. The shaft need not run through the vessel, but may be supported in a collar below it. The body of the vessel may be made entirely of lead, or of any other metal, and lined with lead; its form may be varied considerably, it only being necessary that its characteristic properties be carefully preserved.

I have thus given the mode of producing the protoxide which experience has shown to be a very good one, and I believe the best; but I do not limit myself to this particular mode of forming the protoxide, but occasionally take this oxide prepared in any other way, and submit it to the subsequent operations by which the pigment in question is formed.

The yellow protoxide, produced as above, or the protoxide obtained in any other way, is to be placed in a vessel, with a considerable quantity of water, and diluted sulphuric acid is then poured among it, agitating the mixture not only during the pouring, but for a considerable space of time, and it will be found that the protoxide of lead will be thereby converted into a white pigment, which is a peculiar sub-sulphate of lead, possessing properties not found in the ordinary sulphate of lead; the quantity of sulphuric acid required will be about two pounds to every twenty pounds of the oxide. The ordinary sulphate is obtained by precipitating the lead from any of its soluble salts by means of sulphuric acid; as from the acetate or nitrate of that metal; the sulphate so produced will be a white powder, but it will not possess the body, or other properties, which fit it to be substituted for the carbonate of lead in painting; whilst that prepared in the way which I have indicated will be found to possess these properties in an eminent degree.

What I claim, therefore, as my invention, and wish to secure by letters patent, is the above described mode of producing a white pigment with a base of lead, by pouring the sulphuric acid into the mixture of water and the protoxide of lead, in the manner, and for the purposes, herein set forth. I also claim the triturating vessel, constructed substantially in the way described.

WILLIAM CUMBERLAND.

Remarks by the Editor.—Although a white pigment may be produced by the process described, it is believed, and this belief is strengthened by information obtained from a credible source, that this pigment will not possess the body necessary to render it a substitute for white lead; it is also said not to retain its colour, but to become yellow. Time enough has elapsed since the issuing of the patent to bring these things fairly to the test, but from some cause or other, the manufacturing of the article in the large way, which was commenced in New York, has been suspended, and we are, therefore, without that kind of information which a full and fair trial alone can furnish. We have given the references to the triturating machine, but have not deemed it of any importance to accompany it with an engraving.

Specification of a patent for imparting to Articles of Iron and Steel an increase of strength. Granted to WALTER R. JOHNSON, *city of Philadelphia, June 30th,* 1838. *Antedated December 30th,* 1837.

To all to whom these presents shall come: Be it known, that I, Walter R. Johnson, of the city of Philadelphia, in the state of Pennsylvania, have invented a new and useful improvement in the manufacture of wrought or malleable iron and steel, and of articles formed thereof; being the imparting to said materials of an increase of strength, by means of a process which I call thermo-tension, and that the following is a full and exact description of carrying into effect my said improvement.

The said process is founded on the principle that the strength of said materials is increased by means of mechanical stretching, or straining, at a high temperature.

I perform the said process in the following manner: I first determine in the usual manner, by trial and calculation, what strain might, at the ordinary temperature of the air, and before my improvement has been applied to it, be sufficient to break the particular piece of metal, or manufactured article, intended to be improved by the process of thermo-tension.

I then, by means of any suitable apparatus for applying heat and measuring temperature, subject the piece or article to be strengthened, to a temperature not exceeding seven hundred degrees Fahrenheit, preferring that of five hundred and fifty degrees for most kinds of iron, not restricting myself, however, to the same temperature for all kinds of iron and steel, but varying to a higher or lower temperature, according as the same shall be found most serviceable for the particular kind which is undergoing the process.

When the proper temperature has been attained, I apply, by means of any suitable apparatus for applying and measuring mechanical strain, a force equal, or nearly so, to the calculated strength of the specimen or article under process, and continue to apply the same as long as the metal continues to be stretched by it.

I contemplate the application of the improvement and process above described, herein called the process of thermo-tension, to the metals, wrought or malleable iron and steel of whatever form, in which an increase of direct cohesion may be found useful, whether the same have been manufactured by rolling, hammering, drawing, or by any other process, as I do not confine my improvement to any particular form of materials, or of articles manufactured therefrom.

What I claim as my improvement in the art of manufacturing iron and steel, and of articles formed therefrom, is the submitting of them, while at high temperature, to mechanical stretching, or straining, as above specified, for the useful purpose of increasing their direct cohesion, by whatever means the necessary force shall be applied, and measured, or the requisite temperature communicated and regulated.

WALTER R. JOHNSON.

Advantages of Compressed Peat, or Turf, as a fuel for Steam Engines, and in the Reduction of Iron Ore.

From a communication addressed to the London Journal of Arts, Sciences, and Manufactures, by C. W. Williams, it appears that by a compression of the upper portions of peat or turf bogs, and working the condensed material, a compact fuel may be obtained, surpassing, in strength and other good qualities, the best coke obtained from bituminous coal.

The following extract presents the results of the experiments:

In pursuing the inquiry as to the manufacture of turf coke, I fell naturally into the common error of taking the lower portions of the bog in preference to those nearer the surface; and from this circumstance, that the latter, on account of their lightness, appeared wholly unsuited to the purpose; while the former, from their greater comparative density, seemed alone available in producing a coke which could stand the blast. From the lower strata a sufficiently dense coke could be formed, by the aid of suitable coking stoves; but it was found to be so impure, and impregnated with so large a proportion of incombustible and deleterious matter, as to have an injurious effect on iron, from an acid which it was supposed to contain. From the upper strata, and particularly where they were composed of bog moss, which had made but little progress towards decomposition and solidification, I obtain an exceedingly pure carbon, giving a very small per centage of useless, and no injurious, matter. This upper portion of the bog, however, was of so light and porous a texture, and so apt to re-absorb moisture, by which its heating properties were much reduced, that it would scarcely repay the labour of cutting and saving, even for domestic fuel, while the lower strata, on the contrary, often approached the solidity of coal. This superior density had been acquired, in some degree, by the decomposition and consequent solidification of its vegetable fibre, but still more, by the consolidation, through ages, from the pressure of the superincumbent mass, often to the depth of twenty or thirty feet. But this great density, valuable as it may be, had been obtained at the expense of its purity and heating properties, by the addition of many heterogeneous and incombustible substances; and which, *pro tanto*, and without reference to their chemical effects, deteriorate its calorific power and usefulness as a fuel.

I may here observe, that I have burned the compressed peat coke, which forms the subject of the following analysis, in a small room, in a stove resembling Joyce's stove, standing on the table, for four days and nights successively, during which it was never extinguished, and, without any perceptible unpleasant smell, or other annoyance.

Now, having thus ascertained that the upper and lighter portions of the bog had the greatest purity and heating power, weight for weight, the difficulty presented itself of combining density with purity, and which in the natural state do not co-exist.

In this I have completely succeeded, having obtained a coke, from the lighter portions of the bog, possessing not only double the density of wood charcoal, and equal to that of coal coke, but possessing that purity which is so essential in the working of iron. To ascertain the relative values of the compressed peat, and peat coke, as compared with coal, coal coke, and

charcoal, I had a very accurate analysis made by that able experimenter, Mr. Everitt, and whose report I here subjoin:

Report of Experiments on Pressed Peat, and on Coke made therefrom.

Density.—The density or specific gravity of water,			1000
Compressed peat, the thinnest and hardest pressed,			1160
Ditto, the thicker, or less pressed,			910
Peat coke, the thinnest or hard pressed,			1040
Ditto, the thicker or less pressed,			913
The resin fuel,			1140
The resin alone,			1110
The hardest and dry woods, such as oak, ash, elm, vary from	800	to	885
And the lighter woods, such as poplar, pine, &c., from	383	—	530
Charcoal from hard woods, varies from	400	—	625
Coals vary from	1160	—	1600

Hence we see that the hardest compressed peat is denser than the hardest woods, in the relation of 1160 to 885; and compared with some of the lighter woods, nearly double. Further, that the coke prepared from the hardest compressed peat, is nearly double the density of ordinary charcoal. In common practice, it is reckoned that 100 lbs. of charcoal occupy the same space in a measure as 200 lbs. of coke. The peat coke would, weight for weight, occupy the same, very nearly, as common coke.

Calorific Power.—The next point of investigation was the calorific power, as compared to coal, common coke, and charcoal.

The usual method of making assays of this kind, is to burn weighed quantities of the respective fuels, and endeavour to ascertain how much water each respectively will raise a given number of degrees, or convert into vapour. But experiments of this sort, unless made on a very large scale, cannot lead to any comparable results. It is given in Berthier, (Essais par la voie seche, vol. i., p. 289,) as being the result of accurate experiments, that a given weight of charcoal will raise 78 times its own weight of water from 32° to 212°, or boil off in vapour $11\frac{8}{10}$ its weight: which data do not differ materially from the results obtained on a large scale, by J. Parkes, (see his paper in the Transactions of Civil Engineers," vil. ii, p. 161.) Now we know, from actual trial, that weighed portions of coke, charcoal, &c., used under stills and boilers, holding only from 5 to 10 gallons of water, will not produce $\frac{1}{10}$ of this effect. I am here convinced of the utter futility of trusting to any such experiments on a small scale, with the view of having any thing like an approximation to the true relative values of fuel; even in the best constructed calorimeters, where only a pound or so of the fuel is consumed, it is very difficult to command uniformity through any two experiments. I was here induced to adopt the method recommended by Berthier, in his work, vol. i., p. 228, in order to obtain the relative values of these fuels.

It is assumed, from the results of almost all experiments, that the absolute quantity of heat generated, during the combustion of any fuel, is in exact relation to the quantity of oxygen consumed on entering into combination: hence in order to ascertain the relative calorific powers of fuels, it is only necessary to ascertain the quantity of oxygen each consumes in burning.

The best mode of doing this is to mix a weighed quantity of the fuel with a slight excess of litharge, (oxide of lead) and find what quantity of metallic

lead is reduced. It is to be remarked, that this method cannot be applied to such fuels as contain any volatile matter, from Berthier, (and which also agreed with some trials made by me on the same substances.)

10 parts of pure carbon will give of lead . .	340 grs.
10 parts of good wood charcoal, from . . .	300 to 323
10 parts of dry woods, from . . .	120 — 140
10 parts of good coke, from . , .	260 — 285

It may be here remarked, that assuming the principle, which is the foundation of this mode of assaying, to be correct in practice, it is susceptible of great accuracy; for, as every *single grain* of carbon produces 34 grains of lead, any error in estimating the lead is reduced to $\frac{1}{34}$th in estimating the carbon.

The following results are averages of two, and sometimes three, experiments on the same fuel; and in many cases the metallic lead in two consecutive trials did not differ more than 2 grains, which corresponds to only $\frac{1}{17}$th of a grain of pure carbon.

10 parts of the peat coke—this was picked surface peat—gave	277
10 parts of peat coke, lower strata, ...	250
10 parts of the pressed peat, ...	137

The resin fuel, containing so much volatile matter, could not be tried in this way; and its calorific value could not be ascertained from the difficulty of arriving at any satisfactory result, except on a large scale.

The above numbers represent the relative quantities of heat which can be produced by the same quantities of each of the fuels; and in cases where quantity of heat alone is the consideration, these numbers will also represent their relative values.

But intensity of heat is often of more consequence than quantity; and intensity depends very much on the density of the fuel. Thus, charcoal can never produce so high a heat as coke; and, in this respect, the denser peat coke and common coke are about equal. These comparisons are quite irrespective of any foreign matter being present which may be injurious to the quality of iron, where the fuel is used for reducing the metal from its ore, or for working iron by fire generally, or when it is used under iron boilers for generating steam.

To see how far it was probable or not that the peat coke contained matter likely to act injuriously in this respect, like some coke, portions were burnt in a variety of ways, when no sulphurous acid smell could, in any case, be perceived; sulphur, or metallic sulphurets, are the usual ingredients in common coke, to which their corrosive effects on iron boilers is to be attributed; and such coke, during burning, always gives very perceptible quantities of sulphurous acid gas.

As the nature and quantity of ash is sometimes of importance, I have also investigated these points with great care.

An average of two experiments, where 1000 grains of peat coke (made from the surface peat) were burnt till all carbonaceous matter was consumed, gave $\frac{5}{100}$ for the quantity of ash of a light buff colour.

100 grains of such ash contain common salt,	3. 5
Silica—sand and silica combined,	15. 0
Sulphate of lime,	22. 5
Carbonate of lime,	43.25
Magnesia and carbonate of magnesia,	15.00
Alumina,	0.75
	100.00

The ash contained no carbonate of potassa, and is remarkable for the large quantity of magnesia present.

From my trials I am of opinion,—1st, That the peat coke examined by me contains nothing which would, during the burning, be more injurious to iron than wood charcoal or the best coke—whether it be used to work iron, or under boilers for the generation of steam,

2d. That it is equal to the best coke, weight for weight; in heating power, a little inferior, weight for weight, to wood charcoal, where quantity of heat is the only consideration; but where bulk of stowage, and high intensity of heat are important considerations, it is superior to wood charcoal.

THOMAS EVERITT.

London, Jan. 18, 1839.

The above analysis was made on turf from Lancashire; but, from other experiments, I find the turf from many of the bogs in Ireland exceeding it in purity, and containing a much smaller proportion of incombustible matter.

In considering the foregoing report and analysis, the great density of both the peat and peat coke, though produced from the lighter portion of the surface turf, is remarkable; the compressed peat being 30 per cent. denser than oak wood, and double that of the lighter woods, while the coke is double the density of charcoal, and on a par with coal coke.

I may here add, that this density, which is so valuable where intensity of heat is an object, may be still further increased, and with little additional expense.

This being the first time that the results of the litharge test, as applied to turf coke, has been communicated in this country, the value of which Berthier, in his elaborate and admirable essay on combustible bodies, has fully established, I may be permitted to say, that its accuracy, and the small amount of practical error to which the process is liable, as shown by Mr. Everitt, gives it a high claim to our attention, although to persons not familiar with the nature of chemical tests, it may not be so self-evident. We here see that the extraordinary attraction which carbon has for oxygen, and the power which it thereby exercises of de-oxidizing metallic oxides, renders the litharge test the most suitable for determining the absolute purity and calorific powers of the various cokes, at least on a small scale. The carbon, under a high temperature, uniting with the oxygen in proportion to its calorific powers; while the lead, being thus deprived of that which is essential to its state of oxide, is precipitated in its pure metallic form, the relative weights so thrown down, representing the true combustible values of the several cokes.

It will be observed that Mr. Everitt, in stating the quantity and intensity of the heat given out by peat coke, adds, that these are irrespective of the presence of any foreign matter which may be injurious to the iron. Now, we know that many foreign substances do enter into the composition of coal

and coke, and do exercise a very injurious influence over iron and steel in the furnace and forge. In this respect, the importance of the peat coke becomes apparent; iron is not only sooner brought by it to a welding heat, but it is found to work softer, and with less of that scaling which is so injurious, particularly in the operation of welding.

These facts I have proved both in the furnace where large boiler plates are heated, and in the operations of the forge where even the worst iron was improved in quality.

It is not an unimportant consideration that peat coke may thus be produced from that portion of the bog which has ever been rejected as a domestic fuel, when a denser kind is to be obtained. Again, that it is precisely that description of turf which most abounds in Ireland; and in most of the large bog districts has hitherto been regarded as an absolute incumbrance, alike unfit for fuel, and for conversion to agricultural purposes. This arises from its extreme porousness and levity—its being so far removed from that decomposition which is essential to the vegetative functions of all soils, and also to its susceptibility of the extremes of excessive moisture and excessive drought —overcharged in wet seasons, and amounting to a mere *caput mortuum* in dry ones.

The resin fuel, alluded to in the foregoing report, is an artificial coal, formed by a union of this peat coke and bituminous matter up to the point of saturation. Of the uses and properties of this fuel, as well as of other advantages derivable from the application of peat, I shall, with your permission, on a future occasion submit to your consideration.

C. W. Williams.

Preventing the Oxidation of, and Colouring Metals.—Messrs. Elkington and Barratt's Processes.

Messrs. Elkington and Barratt's invention consists of certain modes of coating metals with zinc, and zinc and mercury; and a mode of colouring iron and steel.

In order to coat copper and brass with zinc, there are mixed in an earthen vessel seven parts of muriatic acid, (specific gravity about 116,) and 100 parts of water, both by weight; and to these are added four parts of zinc, in the state of powder, or pieces. These articles are allowed to remain twenty-four hours, or until the acid and zinc cease to act upon each other, and the solution thus obtained is poured into a convenient vessel for boiling it, adding a quantity of zinc in powder, or in thin pieces. While boiling, the articles to be acted upon are immersed therein, bringing them into contact with the metallic zinc, and they will speedily become coated therewith. They are then removed, and washed with water and dried. In using this solution of zinc, if the articles are of iron or steel, they are previously coated with copper; and this is effected as follows: the articles are first cleansed or pickled in dilute sulphuric acid, composed of one part concentrated acid to sixteen parts of water; and having prepared a solution of sulphate of copper, commonly called blue vitriol, the iron is immersed therein while cold, for a few seconds, and speedily removed and washed. This is repeated one, two, or three times, or until it is found that the iron is perfectly coated; care must be taken not to allow it to remain too long in the solution of copper, or the copper precipitated on the surfaces becomes loose. If a strong coating of zinc be required, the processes of coppering and zincing are repeated,

and it has also been found, that if the articles, when of copper, or if of iron, after they have been coppered, are introduced into a dilute solution of nitrate of mercury, and then again boiled in the solution of zinc, that the same object is obtained. The nitrate, or any other convenient solution of copper, may be substituted for the sulphate.

Another process is as follows: take dilute muriatic acid in about the proportion of one part acid (the specific gravity 116,) and thirty parts of water, into this introduce a quantity of zinc, in powder or in small pieces. The articles of iron are then to be placed in the acid, and kept in contact with the zinc during the process, which will require from two to five minutes, or until they are evidently coated with zinc; then remove, wash and dry them, as before.

Various metals, as iron, steel, copper, brass, &c., may be coated with the amalgam of zinc, and although this may be effected by using the two metals, in almost any proportions, it has been found that six or seven parts of zinc, with one part of mercury, will answer best; these are amalgamated by heat, or by agitating the two metals in contact with dilute muriatic, or other convenient, acid; the zinc being previously granulated, or reduced to small pieces. To this amalgamated zinc, when effected by heat, add dilute acid, as before, and then introduce the articles, which may require to be kept occasionally stirred. Instead of using the muriatic acid, some salts are employed, as the muriate, or sulphate of ammonia, in the proportion of one of salt to thirty ounces of water, or thereabout; and other acids than the muriatic may be employed, as ascetic, sulphuric, &c., and which require no other directions than to employ them of about the same strength as directed for the muriatic acid. It is preferable to employ these solutions in a hot or boiling state, as the effect is thereby obtained in a shorter period; but the processes where the free acid is used, may be successfully performed in a cold state, the acid and water to be added occasionally, as the solution becomes reduced in strength or quantity, by the boiling or action upon the metals to be coated.

An amalgam of zinc may be employed in a melted state for some articles; in which case, and particularly if they are of iron, they require to be well pickled or cleaned, and also to be immersed in a solution of muriate of ammonia, to induce the perfect adhesion of the amalgam, which amalgam may be varied in almost any proportion of the two metals; but the proportions now given are considered best.

The oxides of the metals may also be used in the same manner, instead of the metals, or in conjunction with them; as, for example, a solution of zinc may be made with the oxide of that metal, instead of using the metal itself, and so also with the oxides of mercury. Messrs. Elkington and Barratt's processes may be applied in connexion with the means patented by Messrs. Craufurd and Fontainemoreau.

The process for colouring metals is as follows:—To colour iron and steel to imitate brass; first wet the iron or steel by means of a solution of copper, as already described, and having afterwards boiled it in the saturated solution of zinc, having excess of zinc therein, until perfectly covered, remove it and dry it in sawdust, and then submit it to heat in a closed oven, until the required colour is obtained, and which is easily observed by looking occasionally at the articles during the process. They are afterwards to be pickled in a dilute acid, and washed and dried.

A process called "Similoring," from the words "*simile l'or*," has been before practised for colouring copper and brass, and which consists in ob-

taining on the surface a thin coating of zinc, and submitting the articles so prepared to the action of heat, till a colour approaching to that of gold is obtained. The object of the present invention, so far as it relates to coating copper and brass, is to obtain a good and sufficient coating of zinc on the surfaces, in order to prevent or retard oxidation. The use of heat is omitted, which would be prejudicial to the coating of zinc.

Local Attraction in Iron Vessels.

On Friday evening, the 22d March, the Theatre of the Royal Institution was crowded to hear Dr. Faraday's lecture on the plan recently introduced by Professor Airy, the Astronomer Royal, for neutralizing the effect of iron steam vessels on the compass.

It is well known that this valuable and indispensable instrument has hitherto been quite useless in these vessels, unless removed to a most inconvenient height above the decks. This was noticed by Lieut., now Capt., W. Allen, in the Alburka, in Lander's last expedition to the Quorra; and as another instance, it is related of the Rainbow, the iron steamer on board of which Mr. Airy's experiment was made, that her commander, at the close of a most anxious voyage from Liverpool, (where the vessel was built) was so much at a loss about his situation when off the Isle of Wight, that he was obliged to ask a fisherman where he was; on being told that he must steer E.S.E. (we think it was) to gain his port, he replied that he would give a good deal to know in what direction E.S.E. was, for being in an iron vessel, his compass was useless.

It was on the arrival of this vessel at Woolwich, that Professor Airy was employed to institute his inquiries respecting the best means of rendering the compass available in iron steamers.

Dr. Faraday, in giving a general account of the method adopted by the Professor in his experiments, illustrated his subject by means of a large plate of sheet iron, which represented the vessel, above and towards one end of which, a horizontal magnetic needle was placed, similar in position to the binnacle compass. The sheet of iron was then made to traverse on a central pin placed immediately under the needle, by which arrangement the process of swinging the vessel was very simply exemplified.

Mr. Airy, we are informed, having swung the vessel in the usual manner, ascertaining for each point of the compass the magnetic variation, and then by vibrating the needle under similar circumstances, he also obtained the comparative magnetic intensity. By the application of mathematical reasoning to these data, he was enabled to estimate the general direction and amount of the disturbing force, which was thus so michievously exerted in the needle, and to counteract which a remedy was now to be sought.

From the extraordinary effects exhibited on the needle during these investigations, the inference previously drawn by Capt. Johnson from his interesting experiments on board the Garryowen, in 1837, was confirmed, namely, that the iron vessel did not act merely by inductive influence as a mass of soft iron, but as a regular and permanent magnet, exhibiting the effects of determined polarity.

Professor Airy, under these circumstances, has employed artificial magnets as "correctors," and so places them as to neutralize the effect of the vessel, and thus leave the needle subject to the earth's magnetic influence alone. It is obvious that the position of the "correctors" must be ascertained by separate experiments for each vessel.

Dr. Faraday stated that the Professor's plan had been tried with complete success on board the Ironsides, in her voyage to South America, and also on board the Rainbow, on her recent trip to Antwerp, but it can scarcely be expected that the complete success of this ingenious method of Professor Airy's should be securely established without much longer experience. When we consider the very complicated character which a vessel, considered as a magnet, must under all circumstances present, her extreme liability to change her magnetic condition by concussion, by alteration of trim, &c., and when we further take into account the effects consequent on change of temperature, and on the vessel's removal from station to station on the earth's surface, we may reasonably expect that the plan will still meet with many practical difficulties, ere it can be pronounced perfectly successful. Much, however, has been effected, and we cannot but congratulate the public on the introduction of a plan so happily conceived, and thus far so successfully applied.

The compass is now no longer a useless instrument on board our iron vessels, and though much caution must still be exercised in its application, the principal difficulties seem to be removed, and the commanders of our iron vessels, with proper skill and care, may now perform these voyages, (the short ones at least) with confidence and comfort.

Dr. Faraday, in concluding his subject, suggested the propriety of some public person being appointed to superintend the application of these "correctors" whenever they may be employed, since the principle, however good in itself, if carelessly or ignorantly misapplied, might be productive of the most disastrous consequences. Lond. Naut. Mag.

Preparation of Prussian Blue. By Lewis Thompson.

In the usual mode of manufacturing Prussian blue, the requisite carbon and nitrogen are obtained by decomposing animal matter in contact with potash. In this process, the potash, being reduced to the metallic state, causes the formation of cyanogen, in consequence of its affinity for that substance. The quantity of nitrogen furnished by a given weight of animal matter, is not large, and, in the material employed by manufacturers, seldom perhaps exceeds eight per cent.; and of this small quantity, at least one-half appears to be dissipated during the process, thus producing an enormous waste of material, and at the same time increasing the size of the apparatus. Reflecting on these circumstances, it occurred to me that the atmosphere might be made to supply, in a very economical manner, the requisite nitrogen, if allowed to act on a mixture of carbon and potash, under favourable circumstances. The experiment proved, on trial, to be correct, and in some measure exceeded my expectation; for the carbonaceous matter employed may be worked over again many times, and is even improved by each operation. I found it necessary to use iron, for a reason which will be apparent in the explanation of this process; when iron is not employed, a much higher temperature is required.

To produce Prussian blue, the following method may be adopted, but experience alone can teach us the best proportions; and in this, as in most of the arts, the caprice of each manufacturer will probably lead to the adoption of various proportions of the ingredients used.

Take of potash, or pearlash, ...	2 parts;
Coke, cinders, or coals, ...	2 parts;
Iron turnings, ...	1 part.

Grind the whole together into a coarse powder, and place it in an open crucible, or other convenient vessel, and expose the whole for half an hour in an open fire to a full red heat, stirring the mass occasionally. During the process, little jets of purple flame will be observed to arise from the surface of the mixture; when these have almost ceased to appear, which will happen in about the time specified, the whole must be removed from the fire, and allowed to cool: water is now to be added, so as to dissolve the matter soluble in that fluid, and the black matter remaining put aside for another operation. The solution, after being filtered, is to be mixed with one part of copperas, and muriatic acid added in the usual way, to brighten the colour of the precipitate. The quantity of Prussian blue produced from a given weight of pearlash or potash is generally about one-fourth of the weight of the pure potash contained in the salt; but the larger the quantity operated upon at one time, the larger is the relative produce. Thus six ounces of pearlash, containing 45 per cent. of alkali, yielded only 295 grs. of Prussian blue, whilst one pound of the same pearlash yielded 1355 grs. The Prussian blue here spoken of, is the pure perferrocyanate of iron.

In this process, the potash is decomposed by the iron, producing potassium, which, being volatile, rises and combines with the carbon of the coke and with the nitrogen of the atmosphere, the oxygen of which has been removed by passing through the fire, or by the coke or cinders. In the mixture, the cyanide of potassium thus formed is next dissolved in water, and furnishes ferrocyanate of iron on the addition of sulphate of iron and muriatic acid, according to the explanation given in most chemical books.

By deflagrating a mixture of nitrate of potash, coke, or small coals, and iron turnings, a mass is obtained which furnishes abundance of Prussian blue; but, in this case, the nitrogen is derived from the decomposition of the nitric acid of the nitrate of potash, for the experiment succeeds equally well in a close vessel. In these experiments, soda may be substituted for potash without affecting the result: the charcoal from most kinds of vegetables cannot, however, be employed in place of that from coals, as it is very porous, and burns away too quickly. The presence of cyanide of sodium in barilla, kelp, and English alkali, is thus easily accounted for; and the small quantity of cyanide of potassium invariably produced during the process of preparing potassium, admits of a similar explanation. Trans. Soc. Encour. Arts.

Reagent for Nitric Acid and Nitrogen. By Desbassayns de Richemont.

The mode of detecting the presence of nitric acid proposed by De Richemont is exceedingly delicate, and depends upon the fact, that a mixture of a concentrated solution of protosulphate of iron and sulphuric acid becomes coloured rose red by the addition of deutoxide of nitrogen, (*Stickoxyd*) or even purple, if the latter is present in larger proportion: the quantity of the nitric oxide necessary for the production of this tint is so small, that an exceedingly minute portion may be detected by it. To detect the presence of nitric acid, add to a small quantity of sulphuric acid the solution to be examined, in such a proportion that the quantity added should equal three-fourths the bulk of the acid. When the mixture has become cool, drop in a concentrated solution of protosulphate of iron, which, if any nitric acid is present, decomposes it, causing the evolution of nitric oxide, which produces the rose-red or purple tint above alluded to. This mode of operating will allow us to detect one part of nitric acid in 24,000 of water.

For the detection of nitrogen gas, De Richemont directs the gas under examination to be mixed with from 3 to 6 times its volume of a mixture of oxygen and hydrogen, (in equal vols.) and the whole detonated in a Eudiometer by the electric spark. The fluid that bedews the Eudiometer after the explosion, is to be mixed with sulphuric acid, to which a few drops of protosulphate of iron in solution have been added: the fluid will assume the rose-red tint if the minutest portion of nitrogen is present. It is of course necessary to avoid any source of fallacy arising from the presence of atmospheric air in the oxygen and hydrogen employed. The action of sulphuric acid in producing this rose colour is so remarkable, that when we have failed in detecting the presence of nitric acid by the ordinary process, from its being present in too small a quantity to tinge the sulphate of iron *brown*, the addition of concentrated sulphuric acid will determine the production of the rose-red tint, if any nitric acid existed in the fluid under examination.—*Journ. für Pract. Chemie.* 5, 207. Lond. & Ed. Philos. Mag.

Quantity of Air required for Respiration.

A great difficulty existed in attempting accurate conclusions, from the diversity of constitutional temperaments, different states of humidity of the atmosphere, the state of insensible perspiration, and also from the admixture of small quantities of foreign gases; in one instance the admixture of $\frac{1}{1000}$ part of sulphuretted hydrogen, was enough to "knock up" a whole room, producing very serious effects. The degree of light was also an important element, ten per cent. of carbonic produces much oppression in the dark; but if strong light be admitted, it becomes tolerable. Dr. Reid stated that at St. Petersburgh, he was informed by Sir I. Wiley, that the cases of disease on the dark side of an extensive barrack, were in the proportion of three to one, to those on the side exposed to strong light, and this uniformly so for many years. Dr. Reid explained the mode he had adopted to ventilate the House of Commons, which he illustrated by diagrams, and demonstrated by the exhibition of a glazed model of the House. The current of fresh air could be introduced either from below or from above, diffused uniformly, and not by violent draughts, but, as it were, insensibly, and was under the most exact control as to quantity. The air, when used for the purposes of respiration and combustion, was conveyed away in an opposite direction from that in which it had been introduced. In answer to a question, Dr. Reid said that he had taken no account of the product of the combustion by which the heat and light were produced, as these products should be omitted in all calculations on the subject. They, if possible, should be carried off so as not to interfere with the immediate supply to each individual. For the purpose of raising the temperature, hot water was used in iron tubes, not raised above 150°. Dr. Reid also stated, in answer to other questions, that he had not made any particular observations on the modifying influence of different articles of clothing, but he believed they did modify considerably the question, those being preferable that were of a very porous nature, allowing an *insensible* application of the atmosphere to the cutaneous surface. *Trans. Soc. Adv. Sci.* Athenæum.

Machine for Raising Water by a Hydraulic Belt. By Mr. Hall.

In this machine, an endless, double, woolen band, passing over a roller at the surface of the earth, or at the level to which the water is to be raised,

and under a roller at the lower level, or in the water, is driven with a velocity of not less than 1000 feet per minute. The water contained betwixt the two surfaces of the band is carried up on one side, and discharged at the top roller by the pressure of the band on the roller, and by centrifugal force. This method has been in practice for some time in raising water from a well 140 feet deep in Portman Market, and produces an effect equal to 75 per cent. of the power expended, which is 15 per cent. above that of ordinary pumps. This method would be exceedingly convenient in deep shafts, as the only limit is the length of the band, and many different lifts may be provided.

Mr. Hawkins had seen a machine very similar, fifty years ago.—Mr. Donkin, without entering on the question of originality, stated that he had seen a machine of this description working with a beneficial effect of 75 per cent., the beneficial effect of ordinary pumps being about 60 per cent. Ibid.

Progress of Physical Science.

A Series of Facts and Observations respecting the Natural Causes of Arborescent or Dendritic Figures in the two divisions of Animal and Vegetable Substances, and in Mineral Formations. By Sir ANTHONY CARLISLE, F. R. S.

These ramifying figures are not the special productions of living bodies, because they also occur in mineral formations, and when they are not the impressions of organized structures.

In some instances of organic nature, arborescent figures depend on tubular vessels, as in animals; but in vegetable structures these figures are composed of solid woody fibres, while the frame work of the wings of insects consists of a solid horny substance.

For the advancement of natural knowledge, and for the improvement of organic physiology, it may be useful to collect and to collate various evidences, in order to establish the laws which direct the formation of similar figures in different bodies.

In many cases, the progressive steps of physical causation are more apparent in mineral bodies than in the complicated and living structures of animals and vegetables; and these examples of resembling figures will, therefore, commence with minerals which present dendritic figures, uninfluenced by the disturbing actions of vitality.

The most simple, and one of the most common examples of dendritic figures, occurs in the manufacture of the cheapest sort of ornamented pottery ware termed the "Mocha pattern." These picturesque figures are made by children who are entirely ignorant of the art of design. While the vessel is in the unglazed state termed biscuit, it is dabbed in given places with a liquid pigment which runs by descent, as the surface of the vessel is inclined, and thus it instantly spreads from trunks into regular subdividing branches; the rough surface of the biscuit and the gradual thickening of the liquid pigment producing these appearances.

Streamlets similarly divaricating, appear on the sea shore where little pools of water remain embanked by sand. The water oozing through the sand issues in streams, and these subdivide, according to the declivity, into arborescing streamlets, which sometimes again reunite into

larger branches, as in the anastomoses, between arteries and veins of animal structures. The same appearances often occur upon clayey or muddy declivities over which streamlets of water flow.

Dendritic figures are also common in many stones which were formerly regarded as petrifactions of previously organized structures. In the compact marly limestone, called lithographic stone, these figures often occur, and generally on the surfaces of laminæ, by which it would seem that the ochry pigment had percolated and spread in the same manner as that described respecting pottery. The moss-agate, certain marbles, and Mocha stone, exhibit similar dendritic figures. The entire bodies of certain corallines assume an arborescent character, as in the *Corallina muscosa* of Ellis.

The next examples of arborescent evolutions occur in the solid woody frame work of the leaves of trees, as displayed after the membranous or parenchymatous substance has been removed by maceration; and a remarkable example of an accommodated structure of leaves happens in the *Ranunculus aquatilis*, in which the floating leaves possess an entire covering of skin, while the submersed leaves are subdivided like those of fennel, as if the water had stopped the evolution of the skin, rendering the organ more like the gills of fishes.

For the better understanding of physiological, and consequently of pathological, phenomena, it is very important to distinguish between physical causes of general influence, and the especial or peculiar causes termed vital, which belong conjointly to organized living bodies; and the facts now submitted must, I believe, lead to more exact and practical discriminations as to the causes of embryotic evolution, the growth of organized parts, the reparation of læsions, and morbid deviations from natural structure.

If it be granted that arborescing vessels are only gross accommodations or appliances of convenience in animal function, and that they always originate under physical direction, and not from a vital or mysterious necessity, we may assume to have made one step further in natural knowledge.

These assumptions may, however, be justly supported by the unquestionable existence of entire, living, distinct animals and vegetables, devoid of arborescing vessels or ramifying fibres. The former occur in dropsical fluids and in uncysted tumours, which are termed globular hydatids; the latter in the *Tremella nostoc*. These hydatids are so far parasitical that they exist only in the natural fluids of living animals. The *Tremella nostoc* has probably a parasitical origin, since it always appears upon moist and decayed wood, or on dead leaves in the spring season.

Edin. New Philos. Journ.

Notice of the Electrical Excitation of a Leather Strap connecting the Drums of a Worsted Mill; in a letter to Dr. FARADAY, *from the Rev.* T. DRURY.

My Dear Sir:—Permit me to describe an extraordinary electrifying machine which I yesterday witnessed, and which I think will be new *even to you.*

It is no other than a leather strap which connects two drums in a large worsted mill in the town of Keighley.

The dimensions and particulars of the strap are as follows:

It is in length,	24 feet,
Breadth,	6 inches,
Thickness,	$\frac{1}{8}$ do.

It makes 100 revolutions in a minute.

The drums, over which it passes at both ends, are two feet in diameter, made of wood, fastened to iron hoops, and turning on iron axles; these drums are placed at 10 feet distance from each other, and the strap crosses in the middle between the drums, where there is some friction; the strap forming a figure of eight. There is no metal in connexion with the strap; but it is oiled. If you present your knuckle to the strap above the point of crossing, brushes of electrical light are given off in abundance, and when the points of a prime conductor are held near the strap, most pungent sparks are given off to a knuckle at about two inches; I charged a Leyden jar of considerable size in a few seconds, by presenting it to the prime conductor. The gentleman who told me of this curious strap, has frequently charged his electrical battery in a very short time from it, and he informed me that it is always the same, generating electricity from morning to night, without any abatement or alteration. If this strap had the advantage of silk flaps and a little amalgam, it would rival the machine in the lecture room in Albemarle street.

Lond. & Ed. Philos. Mag.

ARTICLES FROM THE FRENCH JOURNALS. TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE, BY J. GRISCOM.

Changes of Temperature of the Globe.

M. Arago, in his eloquent "*Eloge historique de Joseph Fourier,*" after adverting to the surprising difference between the vegetation of the ancient and the present world, as is proved by the fossil Flora of France, England, Germany, Scandinavia, &c., which exhibit, for example, ferns 15 metres in height, and whose stems were a metre in diameter, and three in circumference, and mushrooms (lycopodiercées) which, under the most favourable circumstances of equatorial growth, are not more than a metre in height, attained, in the primitive world, in Europe, the height of 25 metres—thus proceeds:—

"The study of animal fossils is not less instructive. I should wander from my subject were I here to inquire into the manner in which animal organization was developed on the surface of the earth; what modifications, or rather what complications, it underwent after each cataclysm; if I even stopped to describe one of those ancient epochs in which the earth, the sea, and the atmosphere, were inhabited by cold blooded reptiles of enormous size; shelled tortoises three yards in diameter; lizards 18 yards in length; *petrodactyls*, real flying dragons, of form so singular, that one might, after examining the proofs, hesitate whether to class them among reptiles, among the mammalia, or among birds. My present design requires but little detail; a single remark will suffice.

"Among the bones which lie nearest the surface, are those of the hippopotamus, rhinoceros, and elephant. These remains of tropical animals are found under all latitudes. They have even been discovered in Melville Island, where the mercury descends to 50° below zero. In Siberia they are so abundant as to have become an article of commerce.

In fact, upon the steep shores of the frozen Ocean, not merely fragments of skeletons, but entire elephants, have been found, covered with flesh, skin and hair.

"I am mistaken, gentlemen, if every one of you has not drawn from these remarkable facts a consequence as remarkable, to which indeed the fossil Flora had already reconciled us,—that, as time advanced, the polar regions of our globe underwent a prodigious refrigeration.

"In explaining these curious phenomena, cosmologists assign no part to possible variations in the sun's intensity; and yet the stars, those distant suns, do not possess that constant or invariable splendour which is commonly ascribed to them. Some of them, in a relatively short period, are reduced to a hundredth part of their primitive intensity, and several of them have totally disappeared. The doctrine of attributing to the earth an original amount of heat which has been gradually undergoing a diminution or dissipation, is that which has been preferred.

"Agreeably to this hypothesis, the polar regions have evidently enjoyed, at very distant epochs, a temperature equal to that of the equatorial regions, which are now the abodes of elephants—although these regions are deprived, for months together, of the presence of the sun.

"The existence of elephants in Siberia did not originate the idea of a primitive terrestrial heat. It was adopted by some philosophers prior to the discovery of animal remains. *Descartes* believed that in the beginning (I cite his own expressions) *the earth differed from the sun only in being smaller.* It was therefore to be regarded only as an extinct sun. Leibnitz honours this hypothesis also by adopting it. He endeavoured to deduce from it, the mode of formation of the various solid strata of the globe. Buffon gave it likewise the weight of his eloquent authority. It is well known that this great naturalist regarded the planets of our system simply as portions of the sun, struck off from that body some thousands of years ago, by the stroke of a comet.

"In support of this igneous origin of our globe, Mairan and Buffon brought into view the high temperature of deep mines, especially that of the mines of *Giromagny*. It appears evident, that if the earth was formerly incandescent, we should not fail to discover in the inferior beds, viz. those which were the last in cooling, traces of their primitive temperature. The observer, who, in penetrating the earth, does not discover the heat to be increasing, might therefore consider himself fully authorized to reject the hypothetical conception of Descartes, Leibnitz, Mairan, and Buffon. But has the converse of this proposition an equal claim to our faith? May not the torrents of heat which the sun has been pouring upon the earth during so many centuries, find their way into the mass of the globe, so as to provide a temperature increasing with the depth? This is an important question. Certain minds, of easy credulity, conscientiously thought they had solved it, by urging, that the idea of a constant temperature was much the *most natural:* but wo to science if such vague considerations, which set criticism at defiance, furnished motives either for admitting or rejecting facts and theories! Fontenelle, gentlemen, would have traced the horoscope in these words, well calculated to humble our pride, but the truth of which is nevertheless unveiled in a thousand places by the history of discoveries: 'When a thing may happen in two ways, it is almost always in that way which seems to us, at first, to be the least natural.'

"Whatever the value of these reflections, I hasten to add, that in the

room of the unsubstantial arguments of his predecessors, Fourier substituted proofs and demonstrations, and we know what these terms imply before the Academy of Science.

"In all parts of the earth, when we descend to a certain depth, we find that the thermometer undergoes no variation, either annual or diurnal. It stands at the same degree and portion of a degree, throughout the year, and in every year. This is a fact; what says theory?

"Suppose, for a moment, that the earth may have constantly received all the sun's heat. Penetrate into its mass to a sufficient depth, and you will find, with Fourier, by the aid of calculation, a constant temperature for every period of the year. You will discover, moreover, that this solar temperature of the inferior beds varies in different climates; but that in each particular country, it must in fact remain always the same at depths which are small, relative to the radius of the globe. Well! natural phenomena are in manifest contradiction to this result. Observations made in numerous mines; observations on the temperature of the water of springs issuing from different depths, all give an increase of our centigrade degree for every 20 or 30 metres of depth. Thus there was some want of accuracy in the hypothesis we are discussing in reference to our fellow member. It is not true, that the phenomena of the temperature of the terrestrial strata, is to be attributed solely to the action of the solar rays. This being proven, the increase of heat observed in all climates, beyond a certain depth, is manifestly the indication of a proper or independent heat. The earth, as Descartes and Leibnitz would have it,—but without resting their opinion upon any demonstrative argument,—becomes (thanks to the accumulated observations of philosophers, and the analytical calculations of *Fourier*,) an *encrusted sun*, whose high temperature may be boldly invoked whenever the observance of ancient geological phenomena may call for it.

"After having proved that there is in our earth a heat proper—a heat whose source is not the sun, and which, if we may judge of the rapid increase which observation furnishes, must be sufficiently high, at the moderate depth of seven or eight leagues, to keep all known kinds of matter in constant fusion, the question occurs, what is its precise value at the surface of the globe; what part we must ascribe to it in the valuation of terrestrial temperature; what part it acts in the phenomena of life.

"According to *Mairan*, *Buffon*, and *Bailly*, this agency is immense. They estimate the heat which in France escapes from the interior of the earth, at 29 times in summer, and at 400 times in winter, that which is derived from the sun. Thus, contrary to general opinion, the heat of the solar orb, which enlightens us, constitutes but a very small portion of that whose happy influence we are enabled to enjoy.

"This idea has been developed with great ability and eloquence in the *Memoires de l'Academie*, in the *Epoch de la nature de Buffon*, in the letters of *Bailly à Voltaire, sur l'origine des Sciences, & sur l'Atlantide.* But the ingenious romance of which they serve as the basis, is dissipated like a shadow before the torch of mathematics.

"Fourier having discovered that the excess of the whole temperature of the earth's surface, over that which would result from the sole action of the sun's rays, has a necessary and determinate relation to the increase of temperature at different depths, he was able to deduce from the experimental value of this increase, a numerical determination of

the excess in question. This excess is the thermometric effect which the central heat produces at the surface. Now, instead of the high numbers adopted by *Mairan*, *Bailly*, and *Buffon*, what does our brother associate prove it to be? The *thirtieth* of a degree, and not more.

"The surface of the globe, which, in the origin of things, was perhaps incandescent, became then cooled down in the course of ages, so as scarcely to preserve a trace of its primitive temperature. Nevertheless, at great depths the original heat is still enormous. Time will notably change the internal temperature; but at the surface, (and the phenomena of the surface are the only ones which can modify or affect the existence of living beings) all the changes are, within a very small amount, accomplished. The frightful congelation of the globe, the period of which was fixed by Buffon at the moment when the central heat should be totally dissipated, is therefore a pure fantasy. On the outside, the earth is impregnated only with solar heat. As long as the sun shall retain its splendour, the sons of man will find, from pole to pole, under each latitude, the climates in which they have been enabled to live and flourish.

"These, gentlemen, are great and magnificent results. In consigning them to the annals of science, historians will not neglect to mark this singular fact, that the geometrician to whom we are indebted for the first demonstration of the existence, in the bosom of the earth, of a heat, independent of solar action, has reduced to nothing the immense part which this original heat was made to act, in explanation of the phenomena of terrestrial temperature.

"To the credit of having liberated the theory of climates from an error which had maintained its ground on the imposing authority of *Mairan*, *Bailly*, and *Buffon*, Fourier has claim to a merit still more splendid. He introduced into this theory a consideration till then totally neglected. He brought into view the part which the *temperature of the celestial spaces*, in the midst of which the earth describes its immense orbit round the sun, must act in the phenomena in question.

"Finding that even under the equator, there are mountains covered with eternal snow; observing the rapid decrease of temperature in ascending strata of the atmosphere, as ascertained in aerostatic elevations, meteorologists had concluded that in regions where the extreme rarity of the air must ever prevent the approach of man, and especially beyond the bounds of the atmosphere, a prodigious cold must constantly prevail. It was not only by hundreds, but by thousands of degrees, that they were disposed to measure the rigours of this vacant space. But, like habit, imagination, *that household fool*, (cette folle du logis) had surpassed all bounds. The hundreds and thousands of degrees became, after the rigid examination of Fourier, reduced to 50 or 60 degrees only. From 50 to 60 degrees below zero is the temperature which the stellar radiation maintains throughout that indefinite space which is cleaved by the planets of our system.

"You all well remember, gentlemen, with what predilection *Fourier* discoursed to us of this result. You know how well he felt himself assured of having assigned the temperature of space to within eight or ten degrees. How deeply is it to be regretted, that the memoirs, in which our *confrere* had, doubtless, included all the elements of this important determination, is not now to be found. May this irreparable loss at least prove to so many observers, that instead of obstinately pursuing an

ideal perfection which it is not given to man to obtain, they will act wisely in making the public, in the shortest reasonable time, the confidant of their labours. Annales de Chim. et de Phys. Avril 1838.

Necrology.—M. Dulong.

Science has recently been deprived of one of the most remarkable men of the age, regarded either in relation to the extent of his knowledge, his singular modesty, or the brilliant qualities of his heart. He was born at Rouen on the 12th of February, 1785, and died, after a long illness, on the 19th of July last. Devoted from his youth to the study of the exact sciences, he entered the Polytechnic School at the age of 16, then studied medicine which he practised for sometime at Paris, but soon abandoned it, in order to give up his mind to those labours which are at once an evidence of the depth of his views and the impulses of his understanding. In 1811, scarcely 26 years of age, he undertook those experiments on the Chloruret of Azote, which destroyed one of his eyes and three of his fingers, but which he resumed, as soon as he was cured of his wounds, in order to instruct his cotemporaries in the nature of this dangerous compound. The researches which he published on the mutual decomposition of salts, soluble and insoluble; his fine memoirs on the combinations of phosphorus and oxygen; his observations on some compounds of oxygen and azote, then on oxalic acid and the oxalates; his labours with Berzelius, when the latter was in Paris in 1819, in order to determine anew the proportions of the elements of water and the density of some elastic fluids; and lastly, those in which he was engaged with Thénard, relative to the property of some metals, of promoting the combinations of certain gases, and to the verification of the beautiful experiments of Dobereiner on the inflammation of hydrogen by spongy platina, will claim for him the esteem and gratitude of all future chemists. The students of the Physical Sciences will, perhaps, be still more indebted to him for the instructive researches which he undertook with Petit on the laws of the dilatation of solids and fluids, elastic and inelastic, and on the exact measure of their temperatures; as, also, those on the specific heat of bodies, which placed beyond doubt the fact that atoms of simple substances have equal specific heats, whatever the difference of their chemical nature; an equality so exact, that in determining the number which expresses the specific heat of any one simple substance, the specific heats of all other simple bodies may be numerically deduced from it, by knowing the atomic weights, deducible from their chemical compounds. This ingenious and fruitful thought has greatly contributed to the progress of the study of the atomic theory.

Finally, his beautiful investigation, in conjunction with M. Arago, in 1829, on the relation between the temperature and the pressure of steam in boilers, will always stand as a model of scientific precision and exactness.

A man endowed with so much sagacity and solid acquirement could not remain long a stranger to the learned bodies of Europe. In 1815 (then 30 years of age) he was in nomination with Girard for the place vacant in the section of General Physics, by the death of Levégue, but in this rivalship he had to yield. In 1823 when Fourier was appointed perpetual Secretary in room of Delombre, Dulong was called to fill his place, and he ever afterwards retained that influence in the Academy

which knowledge, modesty and benevolence cannot fail to confer. Successively professor in the School of Alfort, adjunct of Thénard in the faculty of sciences, then professor of Physics, he was appointed a director of the studies of the Polytechnic School at the time of the revolution, in 1830, and never, certainly, was the place more worthily filled. Affable, kind, indulgent, though firm, in his intercourse with the pupils, they were ever accustomed to regard him as a father, and he, in turn, loved them like his children.* In 1832 when Cuvier was taken from the Academy of Sciences, of which he was a principal ornament, Dulong, by the spontaneous, and almost unanimous, choice of his compeers, succeeded him as perpetual Secretary; but his numerous duties and his delicate health did not permit him long to retain those honourable functions. Simple in his tastes and habits, his life, mild and melancholy, was spent in the bosom of an amiable family and with a few devoted friends. Music, at intervals, was the only relaxation which he allowed himself in the midst of his sober occupations. Disinterested, always ready to afford counsel to the young, and constantly forgetting and denying himself, Dulong was the type of a true philosopher, and his death leaves profound regret in the memory of all who knew him. Society and the Sciences have lost in him one of the noblest hearts and most brilliant minds.

Jour. de Pharm. Sep., 1838.

Progress of Civil Engineering.

Influence of Railways in developing the Resources of a Country.

The Irish Railway Commissioners, in their second Report, have collected a number of interesting facts on this important subject, to show the astonishing effects of increased facility of intercourse. The outline which follows, enumerate sthe principal of these:—These effects are not confined to any country or district, although they are, of course, more striking and rapid in rich commercial ones than in others. The extent to which intercourse is not only increased, but actually created by the facility of accomplishing it, would be incredible but for the numerous and authentic examples of it to be seen in so many different localities, and under as various circumstances. The omnibus conveyances between different parts of London and its principal suburbs, (the same thing, it might have been added, having previously taken place in Paris, and other capitals,) are a familiar and striking instance of this fact. And yet the number, a daily increasing one, of these, has not prevented the establishment and success of steamers continually plying between Westminster and London Bridges, and daily conveying many thousands of persons, although it is a contiguous and parallel line to one of the chief directions of the omnibus traffic. Equally surprising is the number of passengers carried by the steamers down the Thames. Upwards of 500,000 persons were conveyed last year by the steamers to Greenwich, and about 300,000 to Woolwich and Blackwall, independent of the tens, or, perhaps hundreds, of thousands, conveyed to Gravesend, Herne Bay, Margate, Ramsgate, &c., and of considerably more than 1,000,000 who

* The pupils of the Polytechnic School have asked the privilege of going into mourning for M. Dulong.

travel to and from Greenwich by the railway. It is, perhaps, still more astonishing that the land conveyances have nevertheless increased with almost equal rapidity. Two coaches, running twice a day, formed the *only* passenger conveyance between London and Woolwich, not longer than thirty years ago. The omnibuses alone now perform the journey forty-eight times per day, besides the numerous vans and coaches which ply between Woolwich and Greenwich, to take passengers to and from the railway. Only two generations back, there was no means of reaching London from Horsham, in Sussex, a distance of thirty-six miles, but on foot or on horseback. Upwards of thirty coaches now pass through Horsham daily, to and from London, besides post chaises, private carriages, &c., while the traffic of goods exceeds 40,000 tons per annum. This change has been solely caused by the construction of a good road. On the Stockton and Darlington road, the passengers conveyed amounted only to 4000 annually, previous to the opening of the railway—they now exceed 16,000. The average number of passengers on the Bolton railroad is now 2500 per week, although it did not previously amount to 300. The coaches running between Newcastle and Carlisle, prior to the railway, were only licensed to carry 343 persons per week, or both ways, 686; now 1596 are, on the average, conveyed the whole distance every week. On the Dundee and Newstyle line, the railway has increased the annual number of travelers from 4000 to upwards of 50,000. Between Liverpool and Manchester, the number of passengers by the coaches was formerly 146,000 in the year; it is now more than 500,000, by the railway alone. The same, if not a more surprising, result has taken place in foreign countries. The former traffic between Brussels and Antwerp consisted of about 75,000 passengers per annum—the railroad has raised it to more than 1,200,000! Similar effects have been experienced in the United States, both in the increase of traveling, and in the rapidity and denseness with which the vicinity of railroads and of steam navigation has become located and peopled. Hence the great stimulus which has been given to the construction of railroads in that country; in January, 1835, full 1600 miles of railway had already been completed in the United States, at a cost of about £8,130,000 sterling. These are direct proofs, observe the commissioners, that Ireland is as capable as other countries of being influenced by the same cause, and the backward state of the country presents a stronger obligation, as well as a wider scope, for improvement. The reports and evidence of engineers and of the Board of Public Works, describe the striking effects produced by the opening of good roads through districts previously shut out from that means of intercourse. The traffic, in most cases, immediately surpassed the most sanguine expectations, and gravel roads frequently became so worn in the second year, as to require a substantial covering of broken stones. Until within the last twenty years, coaches and other public conveyances were almost entirely confined to the main roads leading from Dublin to the principal towns, the cross roads from one town to another being without any such accommodation. At that time, Mr. Bianconi, a native of Milan, (said to have been, like so many of his poor countrymen, a traveling vender of images, in which humble trade he had, by great industry and frugality, saved a few pounds,) undertook the speculation of running a car between Clonmel and Cahir, though almost unacquainted with the English language, and scarcely possessing the means of buying a horse and car.

The attempt was, however, successful, and his business has so steadily increased, that his cars now travel all over Munster, and through Kilkenny to Wexford, Carlow, and Mountmellick, in Leinster, and into Sligo and Leitrim in the north-west. He has now ninety-four well appointed, two horse cars (the description of carriage adopted by him, and one of the best means of conveyance in Ireland,) in constant work, and running more than 3000 miles per day. The same improvement followed the introduction of steam navigation. On the Lower Shannon, from Limerick to Kilrush and Tarbert, a steamer was established in 1829, going and returning on alternate days. Independent of the great benefit to those towns, a thriving bathing village has been created at Kilkee, on the previously desert shore, and the neighbouring villages have become places of considerable resort and importance. The traffic now gives full employment to two steamers of large dimensions, which perform the voyage every day. They carried last year 22,417 persons. A similar increase of intercourse has taken place on the Upper Shannon, by means of one large and several smaller steamers plying between Limerick and Shannon Harbour, whence it is continued to Dublin by the Grand Canal. The steamers between Cork and Cove also carried upwards of 10,000 passengers in 1836. Between Great Britain and Ireland, the traffic and intercourse are calculated to have augmented at least twenty-fold since the establishment of steam navigation. The annual number of passengers conveyed between Liverpool and Dublin by the Post Office packets alone, is now about 26,000, and 15,600 persons passed last year between the small port of Drogheda and Great Britain. The increase of traffic in goods between Ireland and Great Britain, has been fully equal to that of personal intercourse. Steamers now regularly ply from Cork, Waterford, Wexford, Dublin, Drogheda, Dundalk, Newry, Ardglass, Belfast, Coleraine, and Londonderry, to London, Bristol, Liverpool, or Glasgow; from two to four of those vessels cross between Dublin and Liverpool every day. Nine-tenths of this traffic (such as that in fat cattle) is entirely new, and even the rest has assumed a degree of importance previously never dreamed of. The value of the eggs exported was alone estimated, in 1835, at £156,039. Even the manner of transacting business has undergone no less a change. Country dealers now find it worth their while to go themselves to sell their goods and make purchases, instead of employing agents in Dublin and elsewhere, as they did formerly. A well arranged system of railways in Ireland would have the effect of continuing and extending through the country the benefits the outports have obtained by the introduction of steamers. For instance, the fat cattle and sheep sent to Great Britain are now entirely drawn from the counties adjoining the eastern ports, or connected with them by canals, as fat animals cannot, without serious injury, be driven any considerable distance. The great feeding counties of Limerick, Clare, and parts of Tipperary and Queen's County, are therefore precluded from participating in these advantages, but a railroad passing from Dublin through those counties would open to them the markets of Liverpool, Manchester, and Birmingham. Among the inducements worthy of notice, as holding out a prospect of support to railroads, may also be mentioned, the numbers from all parts of Great Britain, and even from the Continent, who would resort to Ireland to view the natural beauties of its splendid and varied scenery, and some, no doubt, to acquire a more perfect knowledge of the character and

condition of its people. The proposed line to Cork, passes within a morning's drive of Killarney, and through a highly picturesque country; and should a railroad be eventually constructed to Holyhead, or some other port in North Wales, as the shortest and safest communication with Ireland and America, the tourist might then combine, in a journey of a few days, and at a very moderate expense, the magnificent scenery of North Wales, and the most beautiful and remarkable places in Ireland, from which source a large accession of passenger traffic could not fail to arise during the summer and autumn months. But the moral effects of this intercourse would even outweigh the pecuniary considerations connected with it. Notwithstanding the public discussions to which Ireland has given rise for years past, she is really little known to the British people. Such an influx of visitors to that country would, therefore, produce the most beneficial results, by greatly tending to dissipate that ignorance of each other's habits and feelings, by drawing the inhabitants of the three countries into a closer connexion and intercourse, and by giving a more practical reality to the bond of the union. It would be endless to point out the various other advantages which would arise from this large increase of intercourse and rapidity of communication between Great Britain and Ireland. Among these, the immense benefit from the great saving of time in the transmission of letters, in traveling, and in the conveyance of goods, will readily suggest itself to every man engaged in business. Another prominent advantage would be the effect on the military service of the country, and its influence on the public peace, from the facility and rapidity with which large bodies of troops, with their artillery and stores, and arriving quite fresh at the scene of action, instead of worn out with long and forced marches, could be conveyed at an hour's notice across the kingdom, either to repel foreign aggression, or to suppress domestic outrage. "It would, in fact," adds the report, "be folly to attempt to impose limits to the future influences of this principle, in creating new resources for the population, or in giving directions as yet unknown, to those already possessed. What has already been done upon its very threshold, and, as it were, in the dark, seems but an earnest of advantages to come, when experience shall have shed its full light upon the subject, and brought this wondrous power more within the grasp and the command of man."—*Abstracted from the "Second Report of the Irish Railway Commissioners."*

Lond. Min. Journ.

Artesian Wells.

Mr. Webster observed, that an Artesian well is produced by boring through strata impervious to water, down to another stratum containing water, and so placed that this fluid will rise up through the bore by hydrostatic pressure: that is by the pressure of another part of the water on a higher level. He then pointed out what he considered to be the true source from whence the water found below the London clay, is derived. We must first imagine a great depression in the chalk stratum that covers the chief part of the south-east of England, the boundaries of which depression or basin is marked by the North Downs, Marlborough Downs, and the Chilton Downs, where the chalk is on the surface. Within this depression, we must then conceive a great stratum of sand, lying in the chalk, but less extensive,—or rather several strata of sand alter-

nating with several beds of coarse pipe-clay, but in a very irregular manner. This bed is named the sand and plastic clay; and this sand contains a large quantity of water, so as to be, in some places, almost of the nature of quicksand. Over these last strata lies a very thick one of dark blue clay, called the London clay, which being less extensive still than the sand, leaves a portion of the latter exposed in a belt or outcrop all round the basin. Now when rain falls upon the chalk downs, it descends the slopes in streamlets towards the centre of the basin; and when it meets with the sand uncovered, it sinks into it, passing downwards below the London clay. In course of time, from this cause, the whole of the sand stratum has become full of water, and must continue to be so, except the latter should be drawn out: and it is evident that this water stratum can be exhausted only by raising out of it a quantity of water greater than the supply it receives from the hills all round. The rain which falls upon the London clay cannot add to the water beneath it, since this clay is impervious; and, therefore, land-springs only are found on the top. If a boring be made anywhere through the blue, or London, clay, down to the stratum or sand containing water, the latter will rise in the bore with considerable force, to the same height, or level, as the outcrop of sand between the London clay and the chalk. If this boring be made at a spot which is on a lower level than the source, the water will spout up like a fountain; but if the boring be made in a place where the surface of the ground is higher than the source, then the water, though it will rise, will not reach the surface: and this accounts for the various heights to which the water ascends in various Artesian wells. (We omit the description of the mineralogical characters of these strata, and of the fossils they contain, and confine ourselves to the circumstances connected with the water.) During the last twenty years, a great many perforations have been made through the London clay, from its having been found that simple boring with an auger is sufficient when a small supply only is required: and enough has been done, fully to establish the truth of the geological principle, that the sand stratum, bearing water, extends all under the London clay; and the metropolis stands upon a chalk basin containing an immense quantity of pure soft water, sufficient for the supply of many breweries, and numerous private houses, &c. But now comes the question: is this pure soft water sufficient in quantity, not merely for the consumption just mentioned, but for the supply of the whole metropolis, or of several parishes, or of a single parish? With respect to the actual quantity of water in the basin, it is impossible to calculate it with any certainty; for although we can estimate the extent of the sand and water stratum from the map, yet we cannot ascertain its thickness, since this varies in different places. In by far the greater number of borings the thickness has not been taken account of, because the work generally ceases at the top of the sand, when water appears: to say nothing of the impossibility of knowing the proportions of water and sand. Mr. Webster went on to prove that this stratum of sand and water is extremely irregular, and that we cannot have a clear idea of its actual nature, except a much more accurate account of the borings was kept than had been the case. The sand stratum is subdivided, in all probability, by bands of clay: and it is incorrect to assert, as has been done, that it is possible to predict success in sinking in one place, because a successful boring has been made in another; or that the supply of water will be the same in all places. All mention has been

omitted, when speculating on this project, of the well-known failure of many Artesian wells: and it is certain that, in several cases, one well has taken the water from another, proving that the supply in that locality was limited. Mr. Webster next adverted to an experiment which had been made by the New River Company, in endeavouring to avail themselves of the water below the London clay, by sinking a large shaft or well at their reservoir in the Hampstead Road. At a depth of 170 feet they came to the stratum of sand and water, which rose up together, as is usual, into the well; but finding that they could not sufficiently separate the water from the sand, which is the chief difficulty in forming wells on a great scale in the London clay, they passed through this running, or quick, sand, by means of cast-iron cylinders, at an expense of 4,000*l.*, independent of the 8,000*l.* which the well cost, hoping to obtain water by sinking into the chalk below. They found water in that stratum, but in quantity too inconsiderable for their object; and hence this well has been represented as a failure. Mr. Webster stated, that considering this experiment as an important one, he applied to Mr. Mylne, engineer to the New River Company, for information respecting it, and received from him all the information he required. A remarkable discrepancy had appeared in the public statements respecting this well; on one side it having been termed a failure, whereas information was given to the vestry of St. Pancras by one of the workmen who had been employed, that water had been obtained at the rate of 6,350,400 gallons weekly; this Mr. Mylne explained by stating that the term *failure* had been used, not as implying that they had not got water, but that they had not procured it in sufficient quantity to answer their purpose as *matter of trade:* the actual quantity being only 650,000 gallons per week, instead of 6,350,400; less than one-ninth part of what had been reported! Mr. Mylne likewise stated that, so far was the supply from being constant, they were able to work the pump in raising the water, only one-third of their time; because, when they had procured what water trickled in slowly through the chalk, they were obliged to wait until a sufficient quantity was again collected. Mr. Webster seemed to consider the idea of a certain supply of water in the chalk, independently of that in the sand stratum, as a fallacy, or at least extremely problematical; and that the water found there had proceeded from the sand stratum resting upon it, and which had forced its way downwards through numerous minute fissures in the chalk. He observed that the procuring much water at a number of points considerably distant from each other, by no means demonstrated, as had been asserted, the certainty of raising the same quantity by means of a single large well; and he further observed, that since it was a manifest and great advantage which the inhabitants of London now possessed, and which was unknown formerly, that they can have numerous supplies of fine spring water by boring only, it was well worth consideration whether the sinking large shafts, and employing powerful machinery to raise water, might not disturb the sand and water stratum to some distance, so as to destroy, or injure, the subterranean channels by which water reaches those wells, which are already the property of individuals; while at the same time no reliance can be placed on the continuance, without interruption, of a supply on so great a scale as is contemplated from this source. Upon the whole, Mr. Webster gave it as his opinion, that proper and sufficient data had not yet been collected, to establish, upon good authority, the existence of water in sufficient abun-

dance to afford a constant supply to the metropolis, or even a considerable district, by raising it in a single place from below the London clay, notwithstanding borings, or Artesian wells, dispersed through London, fulfil their object in furnishing manufactories, and many private houses, with water.

With respect to the present supply of water to the metropolis, Mr. Webster observed, that although the subject did not come properly within the scope of his lecture, he would just state, that a considerable degree of misapprehension still existed on the subject. The Thames water is often represented as of bad quality. There is no doubt, that in its progress through the capital, it is rendered very impure; but it has been abundantly proved, by the accurate analysis of the most eminent chemists, that when the supply is taken sufficiently high up the river, and conducted into the town in a proper manner, it is of great purity. At present the parishes of St. Marylebone, St. George's, and St. James', are supplied from parts of the river much beyond the influence of the London drainage. Possessing this, and other excellent sources, we cannot be said to be unfavourably situated by nature respecting a necessary of life of the first importance. Athenæum.

Mr. S. Crosley's Pneumatic Telegraph.

The following is a description of the pneumatic telegraph recently proposed by Mr. S. Crosley:—

Atmospheric air is the conducting agent employed in the operation of the pneumatic telegraph.

The air is isolated by a tube extending from one station to another; one extremity of the tube is connected with the gas holder, or collapsing vessel, as a reservoir to compensate for any diminution, or increase, of volume arising from compression, or from changes in the temperature of the air in the tube, and for supplying any casual loss by leakage. The other extremity of the tube terminates with a pressure index.

It will be evident to every one acquainted with the physical properties of atmospheric air, that if any certain degree of compression be produced and maintained in the reservoir, at one station, the same degree of compression will speedily extend to the opposite station, where it will become visible to an observer by means of the index.

Thus, with ten weights producing ten different degrees of compression, distinguished from each other numerically, and having the index at the opposite station marked by corresponding figures, any telegraphic numbers may be transmitted, referring, in the usual way, to a code of signals, which may be adapted to various purposes, and to any language. The only manipulation is that of placing a weight of the required figure upon the collapsing vessel at one station, and the same figure will be represented by the index at the opposite station.

In establishments where the telegraphic communications do not require the constant attendance of a person to observe them, and where periodical attendance is sufficient, the signals may be correctly registered on paper, by connecting with the air tube an instrument called a *pressure register*, also invented by Mr. Crosley, which has been successfully employed in large gas light establishments upwards of fourteen years, for registering the variations of the pressure of gas in street mains. The same instrument produces also an increased range of the

index scale, by which means the chance of errors from minute divisions is obviated.

The projector of the pneumatic telegraph is not in possession of any experimental results on a practical scale by the electro-magnetic, or by the hydraulic, telegraphs, employed at any considerably extended distances, or of their continued operation for any long period of time; nor can he offer much decisive information, of a practical nature, analogous to the operation of the pneumatic telegraph on these points; the following circumstances may, however, be referred to:—

There has been upwards of twenty years experience in the transmission of gas for illumination through conduit pipes of various dimensions. In several instances, the gas has been supplied at distances of from five to eight miles, by low degrees of pressure. As one proof of great rapidity of motion, it has been observed, that when any sudden interruption in the supply has occurred at the works, the extinction of all the lights, over large districts, has been nearly simultaneous. Another instance of the great susceptibility of motion which frequently happens, is the flickering motion of the lights at great distances when water has accumulated in the pipes.

The only experience in the transmission of atmospheric air through conduit tubes, which applies more particularly to this subject, may be referred to at three railway establishments, viz. Edinburgh, Liverpool, and Euston-square, London. In these establishments, air tubes, from $1\frac{1}{4}$ to 2 miles in length, have been employed for the purpose of giving notice when a train of carriages is ready to be drawn up the inclined plane by the stationary engine at the summit, so that it may, without delay, be put in motion. This notice is communicated by blowing a current of air through the tube at the foot of the inclined plane, and sounding an organ pipe, a whistle, or an alarm bell, at the stationary engine. It will be satisfactory to know, that this operation has been regularly performed from two to four years, without one single failure or disappointment.

It may further be noticed, that a trial was made with a tube of one inch in diameter, very nearly two miles in length, and returning upon itself, so that both ends of the tube were brought to one place:—the compression applied at one end, was equal to a column of seven inches of water; and the effect on the index at the other end, appeared in fifteen seconds of time.

Laws have been propounded by eminent men on the expenditure of aeriform fluids through conduit pipes, and of the resistance of the pipes; but these are not strictly applicable to the present question. Under all circumstances, it seems desirable that experiments on a practical scale, at extended distances, should be resorted to, as the most satisfactory guide for carrying into effect telegraphic communications of this kind.

Lond. Mech. Mag.

Prevention of Railway Accidents. *By* WILLIAM RUSSELL.

In the humble hope of drawing more efficient pens to the subject, I offer the following hints:—

1. When a person is in danger of being run over by a train, if he had the presence of mind to get into either of the *outside* spaces, it would be safer than in the *middle one,* (a presumed reason for which will be seen in the 5th article.)

2. Whether the individual be in *the middle space,* or in *either of the lines,*

he should immediately *fall flat on the ground;* it would, in the former case, prevent the commotion of air consequent on the rapid motion of the train, from drawing any portion of his dress towards the carriages; and in the latter case, the entire train would roll over him without doing him the slightest injury, as was exemplified in the case of a Pole, an officer on the Great Western Railroad, who, sometime ago, escaped unhurt, with the exception of a hot cinder falling from the furnace and slightly scorching his face: it is consequently *preferable to lie on the face; the hat* should also be *thrown off*, as there might otherwise be a chance of it coming in contact with some projecting point of the train.

3. It is therefore *safest*, when the individual cannot get to either of the *outside spaces*, (which is undoubtedly the best) to throw himself *flat on the ground*, in the *middle space*, or in *either of the lines.*

4. It is consequently an obvious duty which the various companies owe to humanity, to have their carriages so constructed that there would be sufficient space from the bottom of each (including cross beam or iron work) to the bottom or bed of the lines, that a man of the largest dimensions might lie there unhurt.

5. *The middle space is particularly unsafe* for any one to stand on, when there are two trains going in contrary directions and passing each other at the same instant: in proof of which, a poor man, about a fortnight ago, going to his daily labour, and having to cross the railroad at Kinton, near Harrow, whilst a train was approaching from the Euston-square terminus, instantly ran to *the middle space*, thinking, no doubt, that *there* he would be perfectly safe—but another train, at almost the same instant of time, coming up in a contrary direction, caused such a *commotion of air*, first from being agitated by the one train from east to west, and next this agitated air being met by the other train from west to east, that the poor man must have been, as it were, in the midst of a powerful *whirlwind*, and entirely under its impulse: we may, therefore, without hesitation, come to the conclusion, that his dress must have been blown about in every direction, and consequently come in contact with one of the carriages—thus drawing him towards inevitable destruction. The *commotion of air* here hinted at, may be supposed *hypothetical;* but let a reflecting mind pause before it comes to this conclusion; let a rational being ask himself what effect a body, of the weight and magnitude of an ordinary train, rushing through the air, at the rate, let us say, of 30 miles an hour, or $14\frac{2}{3}$ yards in one second; and another similar body passing by in an opposite direction at the same velocity, through a fluid so subtile as atmospheric air is known to be, and he cannot but be convinced that the agitation must indeed be terrific: hence the poor fellow lost his life. I would say then *avoid the middle space by all means, or, if you prefer it, fall flat upon the ground, with the face downwards.*

6. Might not some simple contrivance, say of the form of an arc of a circle, or that of the fin of a fish, with a spring attached to it, be so placed on either side of *the tender or first carriage*, as to throw off to the right or left any body that might accidentally come in contact with the same?

7. There ought to be the greatest possible vigilance enforced on those officers whose duty it is to see that no impediments be permitted to the free ingress and egress of the trains; and upon no account whatever should their attention be directed to any object unconnected with their duty, more especially when there is a train either on the point of start-

ing, or when near any of the places where they stop. The following account shows the listlessness—I might say heartlessness—of one of those men. "Lord Litchfield and three of his friends were nearly killed about a month ago: the *hour* of the Manchester train was *changed without any notice*, which is a very common occurrence; and when his lordship got to Birmingham, it was gone. His lordship felt very much annoyed, as his royal highness the duke of Sussex and a large party were coming to dine at his seat, Ranton Abbey; he asked whether he could have an engine for himself and party, which was immediately provided. Away they went at great speed, but, owing to the *negligence of a policeman*, in not turning a plate, they were carried with great force *off the line*, and upset into a pit. They were all much injured."

8. In tunnel transits, I would recommend fire works (say a small Catharine wheel) to be placed on the first carriage, to be lighted at the moment of entry, and so constructed as to burn during the entire transit; that the lights should likewise be of one colour for the left hand line, and of a different colour for the right hand one: this would, to a certainty, be the means of preventing such serious accidents as that which happened at the tunnel running from Chalk Farm to the vicinity of Kilburn, when Pickford's train and another came so furiously in contact as to demolish some of the carriages, besides seriously injuring many, and alarming all, of the passengers.

9. In conclusion. If methods such as I have now stated, or others that may be more efficient, be not adopted, the public will, or at least ought, to demand, I say, *emphatically*, *demand*, that *the speed be lessened.* Let the companies look to this; it would certainly not, in a pecuniary point of view, be to their interest to lessen the motion—let them, therefore, apply other remedies. Ibid.

Mechanics' Register.

Substitute for the Sun.

The newly invented light of M. Gaudin, on which experiments were recently tried at Paris, is an improved modification of the well known invention of Lieutenant Drummond. While Drummond pours a stream of oxygen gas, through spirits of wine, upon unslaked lime, Gaudin makes use of a more etherial kind of oxygen, which he conducts through burning essence of turpentine. The Drummond light is fifteen hundred times stronger than that of burning gas: the Gaudin light is, we are assured by the inventor, as strong as that of the sun, or thirty thousand times stronger than gas, and of course ten times more so than the Drummond. The method by which M. Gaudin proposes to turn the new invention to use is singularly striking. He proposes to erect in the island of the Pont Neuf, in the middle of the Seine, and centre of Paris, a lighthouse five hundred feet high, in which is to be placed a light from a hundred thousand to a million gas pipes strong, the power to be varied as the nights are light or dark. Paris will thus enjoy a sort of perpetual day; and as soon as the sun of the heavens has set, the sun of the Pont Neuf will rise. Ibid.

Wheatstone's Electrical Telegraph.

On the bank by the side of the Great Western Railway, the directors are now laying down iron tubes containing wires, for communicating with the various stations, by means of Wheatstone's electrical telegraph. The advantages, if it succeed, will be immense; the expense, we have heard, is about £100 per mile. Ibid.

LUNAR OCCULTATIONS FOR PHILADELPHIA, JULY, 1839.					Angles reckoned to the right or westward round the circle, asseen in an inverting telescope. ☞ For direct vision add 180° ☜	
Day.	H'r.	Min.	Star's name.	Mag.	from Moon's North point.	from Moon's Vertex.
13	7	38	Im. ♍ Virginis	5.6	34°	80°
13	8	38	Em.		270	319
23	12	49	Im. ♑ Capricorni	3.4	189	206
23	13	23	Em.		243	267

Meteorological Observations for February, 1839.

Moon.	Days	Therm. Sun rise	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	26	33	30.00	29.95	N.E.	Moderate.		Cloudy—do.
	2	24	26	29.80	80	W.	Brisk.		Clear—do.
	3	20	35	75	75	W.	do.		Clear—do.
	4	33	41	75	89	W.	Moderate.		Flying clouds—do. do.
	5	19	27	30.06	30.06	N.W.	Brisk.		Clear—flying clouds.
☽	6	10	17	25	25	W.	do.		Clear—do.
	7	12	36	35	23	S.W.	Moderate.		Clear—partially cloudy.
	8	28	48	25	00	S.W.	do.		Clear—partially cloudy.
	9	38	38	29.61	29.90	W.	do.		Cloudy—clear.
	10	14	24	30.30	30.25	N.W.	do.		Clear—do.
	11	20	36	30	29.93	N.S.W.	do.		Clear—cloudy.
	12	24	34	30	30.25	N.W.	do.		Clear—do.
⊗	13	22	40	25	10	E.S.E.	do.		Clear—do.
	14	25	44	10	08	N.S.W.	do.		Clear—do.
	15	30	40	00	00	E.W.	do.		Clear—do.
	16	26	40	05	05	N.E.	do.		Clear—cloudy.
	17	30	34	29.90	29.90	E.	do.	.09	Cloudy—snow.
	18	34	36	87	30.02	N.	do.		Cloudy—flying clouds.
	19	22	35	30.24	25	W.	do.		Clear—do.
	20	24	46	15	15	S.W.	do.		Clear—do.
☾	21	34	47	06	10	S.W.E.	do.		Cloudy—partially do.
	22	34	44	10	15	E.	do.		Clear—partially cloudy.
	23	35	48	10	10	W.	do.		Cloudy—do.
	24	36	46	20	10	E.N.E.	do.		Cloudy—lightly do.
	25	42	50	29.20	29.80	E.W.	do.	.29	Rain—cloudy.
	26	35	38	90	65	N.E.E.	do.	.70	Cloudy—rain.
	27	35	47	40	42	S.W.W.	do.		Cloudy—do.
	28	32	50	47	30	N.W.E.	do.	.85	Cloudy—rain and snow.
	Mean	27.35	38.53	29 98	29.98			1.93	

	Thermometer.		Barometer.	
Maximum height during the month.	50.	on 25th and 28th.	30.35	on 7th.
Minimum " " "	10.	6th.	29.20	25th.
Mean	32.946		29.98	

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

JUNE, 1839.

	County.	Town.	Observer.	Thermometer										Barometer
											Register.			
				7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Lowest.	Mean.	Days omitted.	7, A. M.
1	Philadelphia,													
2	Montgomery,													
3	Bucks,	Newtown,	I. H. Parsons.	67.09	76.13	61.77	90.	51.	68.33	1	45.	55.43	9	29.91
4	Lehigh,													
5	Northampton,													
6	Monroe,	Stroudsburgh,	A. M. Stokes.	59.53	72.38	60.40	86.	44.	64.10	1⅓	.....	.....	.	29.42
7	Pike,													
8	Wayne,													
9	Susquehanna,	Silver Lake,	E. Rose.	58.90	69.23	63.73	80.	50.	63.95	.	48.	53.93	.	28.02
10	Luzerne,													
11	Schuylkill,	Pottsville,	John Porter.	59.60	71.71	62.53	82.	46.	64.61	.	38.	50.15	1	29.14
12	Berks,	Reading,	C. F. Egelman.	63.07	71.03	61.30	85.	48.	65.13	.	....	.....	.	29.68
13	Chester,													
14	Delaware,													
15	Lancaster,	Lancaster,	Conservatory of Arts,	60.65	72.61	64.35	80.	50.	62.97	⅓	49.	58.02	.	29.42
16	York,	York,	Calvin Mason.	67.92	77.26	68.93	86.	52.	71.33	2	46.	57.45	2	29.53
17	Lebanon,													
18	Dauphin,													
19	Northumberland	Northumberland	Andrew C. Huston.	61.88	71.82	63.46	82.	53.	65.72	.	45.	53.23	.	29.38
20	Columbia,													
21	Bradford,													
22	Tioga,													
23	Lycoming,													
24	Union,													
25	Mifflin,	Lewistown,	J. Culbertson, M. D.	65.70	70.79	68.27	80.	56.	68.25	.	....	.....	.	29.22
26	Juniata,	Mifflintown,	Andrew Parker.	63.90	65.37	67.00	80.	55.	65.42	10⅔	....	.....	.	29.56
27	Perry,													
28	Cumberland,	Carlisle,	Prof. W. H. Allen.	63.89	71.48	63.81	84.	53.	66.39	2⅔	44.	56.25	3	29.34
29	Adams,	Gettysburgh,	Prof. M. Jacobs.	61.62	72.69	63.20	85.	51.	65.84	.	45.	55.67	.	29.34
30	Franklin,													
31	Huntingdon,													
32	Centre,	Bellefonte,	John Harris.	59.00	75.65	61.68	90.	45.	65.44	2⅔	40.	49.14	9	29.17
33	Potter,													
34	M'Kean,	Smithport,	Richard Chadwick.	54.93	69.90	55.37	85.	44.	60.07	.	32.	47.30	.	28.15
35	Clearfield,													
36	Cambria,													
37	Bedford,													
38	Somerset,													
39	Indiana,													
40	Jefferson,													
41	Warren,													
42	Venango,													
43	Armstrong,													
44	Westmoreland,													
45	Fayette,													
46	Green,													
47	Washington,													
48	Alleghany,													
49	Beaver,													
50	Butler,													
51	Mercer,													
52	Crawford,													
53	Erie,													

Barometer.						Weather.								Winds.																		
2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.
.90	29.90	30.16	29.67	29.90	1	12 1/3	15	2 2/3	....	...	....	..	3.520	.	.	3	.	.	.	2	.	1/3	.	6 2/3	.	1/3	.	15 1/3	.	.	2 1/3
.45	29.43	29.70	29.	29.43	1 1/3	7 2/3	16	6 1/3	7	....	....	1	4.082	1 1/3	.	3	.	1 1/3	.	1/3	.	2 1/3	1 1/3	5	.	4 2/3	.	7 1/3	1 1/3	.	1 2/3
.04	28.04	28.35	27.70	28.03	.	9	21	.	8	....	...	..	3.320	1	.	.	.	.	.	.	.	4 2/3	1	8 2/3	2	4 1/3	.	7 2/3	2/3	.	.
.08	29.11	29.62	28.88	29.11	.	14 2/3	15 1/3	.	....	....	....	..	2.778	2 1/3	.	3	.	.	.	2 1/3	.	.	.	2 1/3	.	7 1/3	.	8	.	4 2/3	.
.68	29.67	29.90	29.45	29.68	.	11 2/3	18 1/3	.	9	....	...	1	1.989	1	.	1/3	.	2/3	.	2 1/3	.	.	.	3 1/3	.	1 2/3	.	19 1/3	1 1/2	.	.
.42	29.42	29.69	29.16	29.42	.	15 2/3	14	1/3	10	....	....	1	4.560	3 2/3	.	2 2/3	.	1/3	1/3	2	.	3	2	3 2/3	2/3	3	1 1/3	7 1/3	.	.	.
.55	29.53	29.90	29.30	29.54	2	.	.	.	....	....	....	..	3.155	1/3	.	5 2/3	.	.	.	1/3	.	.	.	2 1/3	.	1 1/3	.	17 1/3	2/3	.	2
.36	29.36	29.66	29.14	29.37	.	7 1/3	22 2/3	.	11	....	....	..	4.853	3 2/3	2/3	2/3	.	1 2/3	.	2 1/3	1/3	6 2/3	.	2/3	2/3	1 2/3	1/3	5	2/3	5	.
.19	29.21	29.45	29.04	29.21	.	14 2/3	10 2/3	4 2/3	13	....	....	1	....	.	.	4 2/3	.	.	.	2	.	1/3	.	15	.	2/3	.	7 1/3	.	.	.
.56	29.57	29.79	29.31	29.56	11	.	.	.	....	...	...	..	....	2/3	.	2	.	2/3	.	1 2/3	.	1/3	.	2 2/3	.	4 1/3	.	5 2/3	.	1	11
.32	29.32	29.52	29.09	29.33	2 2/3	8 1/3	18 2/3	3	12	....	....	..	6.943	2/3	.	3 2/3	.	1/3	.	1 1/3	.	1	1/3	2	2/3	6 1/3	1 1/3	1 1/3	.	7 2/3	3
.32	29.33	29.58	29.10	29.33	.	14	16	.	10	....	....	..	4.829	3	1/3	1	1/3	1 1/3	.	1	1/3	3 2/3	2	3 1/3	1 1/3	1 2/3	1	5 1/3	1 1/3	3	.
.19	29.17	29.40	28.96	29.18	2 2/3	7 2/3	19 2/3	2 2/3	8	....	....	..	....	1 1/3	.	3 2/3	.	2/3	.	3 2/3	.	.	1/3	5	.	6 1/3	1/3	5 2/3	2/3	.	2 1/3
.15	28.16	28.40	27.95	28.15	.	13 2/3	16 1/3	.	10	....	....	2	5.478	1/3	.	1/3	.	4	.	2/3	.	1	.	2 2/3	.	12 1/3	.	2 1/3	.	6 1/3	.

N. N. W.	Calm.	Days omitted.	Hygrometer. Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
.	.	$2\frac{1}{3}$	....	.	.....	....	.	806
$1\frac{1}{3}$	.	$1\frac{2}{3}$	....	.	.....	58.19	8	774
$\frac{2}{3}$	.	.	....	.	.....	....	.	885
.	$4\frac{2}{3}$	.	....	.	.....	....	.	766
$1\frac{1}{3}$	.	.	....	.	.....	....	.	770
.	.	.	58.27	1	.....	63.77	1	773
$\frac{1}{3}$	.	2	53.42	2	.....	....	.	771
$\frac{1}{3}$	5	.	....	.	.....	65.73	.	762
.	.	.	....	.	.....	....	.	793
.	1	11	....	.	.....	....	.	767
.	$7\frac{2}{3}$	3	57.59	9	.....	64.	9	765
$1\frac{1}{3}$	3	.	54.50	.	.....	61.86	.	764
$\frac{2}{3}$	.	$2\frac{1}{3}$	....	.	.....	....	.	830
.	$6\frac{1}{3}$	.	65.24	9	.....	65.63	.	777

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